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(71) Applicant: Takeda Chemical Industries, Ltd.
Osaka-shi, Osaka 541-0045 (JP)

(72) Inventors:

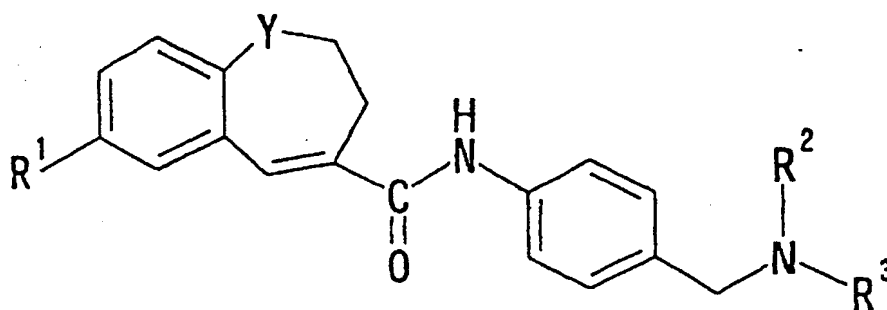
- SHIRAISHI, Mitsuru
Amagasaki-shi, Hyogo 661-0002 (JP)

- BABA, Masanori
Kagoshima-shi, Kagoshima 891-0103 (JP)
- ARAMAKI, Yoshio
Itami-shi, Hyogo 664-0858 (JP)
- KANZAKI, Naoyuki
Ibaraki-shi, Osaka 567-0867 (JP)
- NISHIMURA, Osamu
Kawanishi-shi, Hyogo (JP)

(74) Representative: Lewin, John Harvey
Takeda Patent Office,
11-12 Charles II Street
London SW1Y 4QU (GB)

(54) **BENZAZEPINE DERIVATIVES, PROCESS FOR THE PREPARATION OF THE SAME AND USES THEREOF**

(57) Compounds of the general formula (I):



or salts thereof, which exhibit CCR5 antagonism and exert preventive and therapeutic effects against HIV infections: wherein R¹ is a 5- to 6-membered aromatic ring which bears a substituent represented by the general formula: R-Z¹-X-Z²- (wherein R¹ is hydrogen or optionally substituted hydrocarbyl; X is optionally substituted alkylene; and Z¹ and Z² are each a heteroatom) and may be further substituted, with R being optionally bonded to the aromatic ring to form another ring; Y is optionally substituted imino; and R² and R³ are each optionally substituted aliphatic hydrocarbyl or an optionally substituted hetero-alicyclic group.

Description

Technical Field

5 [0001] The present invention relates to a novel benzazepine derivative, production and use thereof.

Background Art

10 [0002] Recently, HIV (human immunodeficiency virus) protease inhibitors are developed for method of the treatment of AIDS (acquired immunological deficient syndrome) and use of the protease inhibitors in combination with conventional two HIV reverse transcriptase inhibitors provides with a further progress of the treatment of AIDS. However, these drugs and their combination use are not sufficient for the eradications of AIDS, and development of new anti-AIDS drugs having different activity and mechanism are sought for.

15 [0003] As a receptor from which HIV invades to a target cell, CD4 is so far known, and recently CCR5 as a second receptor of macrophage-tropic HIV and CXCR4 as a second receptor of T cell-tropic HIV, each of which is G protein-coupled chemokine receptor having seven transmembrane domains, are respectively found out. These chemokine receptors are thought to play an essential role in establishment and spread of HIV infection. In fact, it is reported that a person who is resistant to HIV infection in spite of several exposures retains mutation of homo deletion of CCR5 gene. Therefore, a CCR5 antagonist is expected to be a new anti-HIV drug. However, so far, there has been no report
20 that a CCR5 antagonist is developed as a therapeutic agent of AIDS.

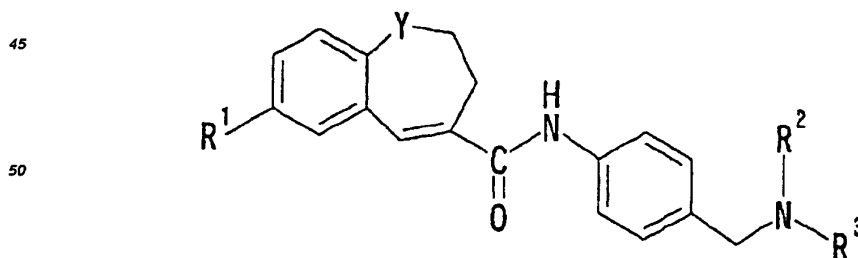
Disclosure of the Invention

25 [0004] In order to investigate an anti-AIDS drug having CCR5 antagonistic activity, it is necessary to clone CCR5 gene from human tissue derived cDNA library, to ligate said gene with a vector for expression in animal cells, to introduce said gene into animal cells and to obtain cells expressing CCR5. In addition, with using this transfectant, it is necessary to screen a compound which strongly inhibits binding of CC chemokine RANTES, natural ligand, to CCR5. However, so far there has been almost no report on a low molecule compound which has this CCR5 antagonistic activity and is suitable for oral administration. The present invention is to provide a novel anilide derivative which is useful for the
30 treatment or prevention of infectious diseases of HIV and, in particular, AIDS and also which is suitable for oral administration, production and use thereof.

35 [0005] The present inventors diligently made extensive studies on compounds having CCR5 antagonistic activity and, as a result, they found that a benzazepine derivative of the following formula (I) or a salt thereof [hereinafter, referred to as Compound (I) in some cases] possesses CC chemokine receptor (CCR) antagonistic activity, in particular, potent CCR5 antagonistic activity and clinically desirable pharmaceutical effect (e.g. remarkable inhibition of HIV infection to human peripheral mononuclear cells, etc.) and also that Compound (I) has superior absorbability when orally administered. Based on the finding, the present invention was accomplished.

[0006] More specifically, the present invention relates to

40 (1) A compound of the formula (I):



wherein R¹ is a 5- to 6-membered aromatic ring which has a group of the formula: R-Z¹-X-Z²- wherein R is a hydrogen atom or an optionally substituted hydrocarbon group, X is an optionally substituted alkylene chain, and Z¹ and Z² are respectively hetero-atoms, and which may have a further substituent, the group R may bind to the

5- to 6-membered aromatic ring to form a ring, Y is an optionally substituted imino group, R² and R³ are respectively an optionally substituted aliphatic hydrocarbon group or an optionally substituted alicyclic heterocyclic group; or a salt thereof;

(2) A pro-drug of the compound as described in the above (1) or a salt thereof;

(3) The compound as described in the above (1), wherein the 5- to 6-membered aromatic ring is benzene, furan or thiophene;

(4) The compound as described in the above (1), wherein the 5- to 6-membered aromatic ring is benzene;

(5) The compound as described in the above (1), wherein R is an optionally halogenated lower alkyl group;

(6) The compound as described in the above (1), wherein X is -(CH₂)_n- (n is an integer of 1-4);

(7) The compound as described in the above (1), wherein Z¹ and Z² are respectively -O-, -S(O)_m- (m is an integer of 0-2) or -N(R⁴)- (R⁴ is a hydrogen atom or an optionally substituted lower alkyl group);

(8) The compound as described in the above (1), wherein Z¹ is -O- or -S(O)_m- (m is an integer of 0-2);

(9) The compound as described in the above (1), wherein Z¹ is -O-;

(10) The compound as described in the above (1), wherein Z² is -O- or -N(R⁴)- (R⁴ is a hydrogen atom or an optionally substituted lower alkyl group);

(11) The compound as described in the above (1), wherein Z² is -O-;

(12) The compound as described in the above (1), wherein Y is -N(R⁵)- (R⁵ is a hydrogen atom, an optionally substituted hydrocarbon group or an optionally substituted acyl group);

(13) The compound as described in the above (12), wherein (R⁵) is C₁₋₄ alkyl, formyl or C₂₋₅ alkanoyl;

(14) The compound as described in the above (12), wherein R⁵ is a group represented by the formula -(CH₂)_k-R⁶: wherein k is 0 or 1, and R⁶ is an optionally substituted 5- to 6-membered monocyclic aromatic group;

(15) The compound as described in the above (1), wherein R² is an optionally substituted straight chain hydrocarbon group;

(16) The compound as described in the above (1), wherein R² is an optionally substituted lower alkyl group;

(17) The compound as described in the above (1), wherein R³ is an optionally substituted alicyclic hydrocarbon group or an optionally substituted alicyclic heterocyclic group;

(18) The compound as described in the above (17), wherein the alicyclic hydrocarbon group is a lower cycloalkyl group;

(19) The compound as described in the above (17), wherein the alicyclic hydrocarbon group is cyclohexyl;

(20) The compound as described in the above (17), wherein the alicyclic heterocyclic group is a saturated alicyclic heterocyclic group;

(21) The compound as described in the above (17), wherein the alicyclic heterocyclic group is tetrahydropyran, tetrahydrothiopyran or piperidyl;

(22) The compound as described in the above (17), wherein the alicyclic heterocyclic group is tetrahydropyran;

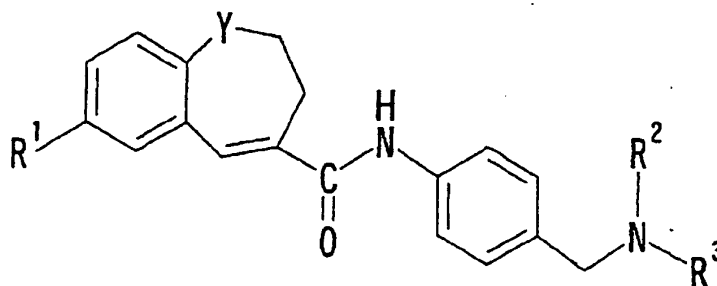
(23) The compound selected from the class consisting of

7-(4-ethoxyethoxyphenyl)-1-ethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 1-ethyl-7-(4-propoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-ethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-ethoxyethoxyphenyl)-1-formyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 1-formyl-7-(4-propoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-formyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-1-propyl-2,3-dihydro-1-benzazepine-4-carboxamide,
 N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-1-propyl-2,3-dihydro-1-benzazepine-4-carboxamide,
 1-benzyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-cyclopropylmethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-phenyl-2,3-dihydro-1-benzazepine-4-carboxamide,

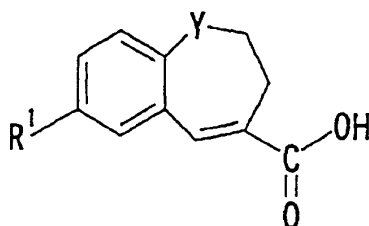
7-(4-butoxyethoxyphenyl)-1-(3,4-methylenedioxy)phenyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-(2-methyloxazol-5-yl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 1-allyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(3-thienyl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-2-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-1-(1-methylpyrazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-(3-methylisothiazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-(1-ethylpyrazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(1-methyltetrazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, and
 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(2-methyltetrazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, or salt thereof;

(24) A pro-drug of the compound as described in the above (23) or a salt thereof;

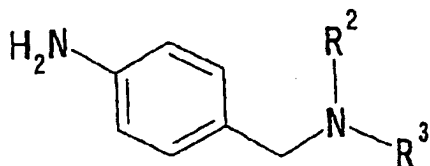
(25) A method for producing a compound of the formula:



wherein each symbol is as described in the above (1), or a salt thereof, which comprises subjecting a compound of the formula:



wherein each symbol is as described in the above (1), a salt or a reactive derivative thereof to a condensation reaction with a compound of the formula:



wherein each symbol is as described in the above (1), or a salt thereof;

(26) A pharmaceutical composition which comprises the compound as described in the above (1) or a salt thereof;

(27) The composition as described in the above (26), which is a CC chemokine receptor (CCR) antagonist;

(28) The pharmaceutical composition as described in the above (26), which is a CCR5 antagonist;

(29) The composition as described in the above (26), which is for the treatment or prevention of infectious disease of HIV;

(30) The composition as described in the above (26), which is for the treatment or prevention of AIDS;

(31) The composition as described in the above (26), which is for the prevention of the progression of AIDS;

(32) The composition as described in the above (29), which is used in combination with a protease inhibitor and/or a reverse transcriptase inhibitor;

(33) The composition as described in the above (32), wherein the reverse transcriptase inhibitor is zidovudine, didanosine, zalcitabine, lamivudine, stavudine, nevirapine, delavirdine, efavirenz or abacavir;

(34) The composition as described in the above (32), wherein the protease inhibitor is saquinavir, ritonavir, indinavir or nelfinavir;

(35) Use of the compound as described in the above (1) or a salt thereof in combination with a protease inhibitor and/or a reverse transcriptase inhibitor for the treatment or prevention of infectious diseases of HIV;

(36) A method for antagonizing a CC chemokine receptor (CCR) in a mammal, which comprises administering an effective amount of a compound described in the above (1) or a salt thereof to a mammal;

(37) Use of a compound described in the above (1) or a salt thereof in preparation of a medicament for antagonizing a CC chemokine receptor (CCR); etc.

[0007] In the above formula(I), examples of the "5- to 6-membered aromatic ring" of the "5- to 6-membered aromatic ring which has a group of the formula: $\text{R-Z}^1\text{-X-Z}^2$ wherein R is a hydrogen atom or an optionally substituted hydrocarbon group, X is an optionally substituted alkylene chain, and Z^1 and Z^2 are respectively hetero-atoms, and which may have a further substituent" represented by R^1 include a 6-membered aromatic hydrocarbon such as benzene, etc.; 5- to 6-membered aromatic heterocyclic ring containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from oxygen atom, sulfur atom and nitrogen atom such as furan, thiophene, pyrrole, imidazole, pyrazole, thiazole, oxazole, isothiazole, isoxazole, tetrazole, pyridine, pyrazine, pyrimidine, pyridazine, triazole, etc.; and the like. Among others, benzene, furan, thiophene, pyridine, etc. are preferable, benzene, furan or thiophene is more preferable, and in particular, benzene is preferable.

[0008] Examples of the "hydrocarbon group" of the "optionally substituted hydrocarbon group" represented by R include (1) alkyl (e.g., C_{1-10} alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., preferably lower (C_{1-6}) alkyl, etc., more preferable lower (C_{1-4}) alkyl, etc.);

(2) cycloalkyl (e.g., C_{3-7} cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.);

(3) alkenyl (e.g., C_{2-10} alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl, etc., preferably lower (C_{2-6}) alkenyl, etc.);

(4) cycloalkenyl (e.g., C_{3-7} cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.);

(5) alkynyl, (e.g., C_{2-10} alkynyl, such as ethynyl, 1-propynyl, 2-propynyl, 1-butylnyl, 2-pentylnyl, 3-hexynyl, etc., preferably lower (C_{2-6}) alkynyl, etc.);

(6) aralkyl (e.g., phenyl- C_{1-4} alkyl (e.g., benzyl, phenethyl, etc.), etc.);

(7) aryl (e.g., phenyl, naphthyl, etc.);

(8) cycloalkyl-alkyl (e.g., C_{3-7} cycloalkyl- C_{1-4} alkyl such as cyclopropylmethyl, cyclobutylmethyl, cyclopentylmethyl, cyclohexylmethyl, cycloheptylmethyl, etc.), and the like.

[0009] Examples of the substituents, which the above-mentioned (1) alkyl, (2) cycloalkyl, (4) cycloalkenyl, (5) alkynyl, (6) aralkyl, (7) aryl and (8) cycloalkyl-alkyl may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxycarbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), C₁₋₄ alkylenedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, etc.), optionally substituted sulfonamide [e.g., a group formed by binding of an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.) to -SO₂-], formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0010] Examples of the "heterocyclic group" of the "optionally substituted heterocyclic group" as substituents of "optionally substituted hydrocarbon group" represented by R include a group formed by removing one hydrogen atom from aromatic heterocyclic ring or non-aromatic heterocyclic ring. Examples of the aromatic heterocyclic ring include 5- to 6-membered aromatic heterocyclic ring containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from oxygen atom, sulfur atom and nitrogen atom such as furan, thiophene, pyrrole, imidazole, pyrazole, thiazole, oxazole, isothiazole, isoxazole, tetrazole, pyridine, pyrazine, pyrimidine, pyridazine, triazole, oxadiazole, thiadiazole, etc. Examples of the non-aromatic heterocycle include 5- to 6-membered non-aromatic heterocycle containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from nitrogen atom, sulfur atom and oxygen atom, such as tetrahydrofuran, tetrahydrothiophene, dioxolane, dithiolane, oxathiolane, pyrrolidine, pyrroline, imidazolidine, imidazoline, pyrazolidine, pyrazoline, piperidine, piperazine, oxazine, oxadiazine, thiazine, thiazadine, morpholine, thiomorpholine, pyran and tetrahydropyran, as well as non-aromatic heterocycle in which a pair or whole bond (s) of the aforementioned aromatic heterocycle is (are) a saturated bond, and the like (preferably, aromatic heterocycle such as pyrazole, thiazole, oxazole, tetrazole, etc.).

[0011] The "heterocyclic group" of the "optionally substituted heterocyclic group" as the substituent for the "optionally substituted hydrocarbon group" represented by R, may have 1 to 3 substituents at an optional replaceable position. Examples of such the substituent include halogen (e.g., fluorine, chlorine, bromine and iodine), nitro, cyano, a hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxycarbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), C₁₋₄ alkylenedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, etc.), optionally substituted sulfonamide [e.g., an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.) binding to -SO₂-], formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc. (preferably, C₁₋₄ alkyl, etc.).

[0012] When the group of the formula: R-Z¹-X-Z² wherein each symbol is as defined above is a monovalent group, that is it does not bind to the 5- to 6-membered aromatic ring to form a ring, as the group R, an optionally substituted alkyl group is preferable, an optionally halogenated lower alkyl group is more preferable, and in particular, an optionally halogenated C₁₋₄ alkyl group is preferable.

[0013] Examples of the "optionally substituted alkylene chain" represented by X include an optionally substituted straight or branched C₁₋₆ alkylene, etc. In said alkylene chain, a straight portion is preferably constituted by 1-4 carbon atoms, and in particular, an optionally substituted straight C₁₋₄ alkylene (preferably ethylene or propylene) is preferable as X.

[0014] Examples of the substituent, which the "alkylene chain" of the "optionally substituted alkylene chain" represented by X may have, include any one which can bind to a divalent chain constituting the straight portion, for example, C₁₋₆ lower alkyl (e.g., methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, etc.), lower (C₃₋₇) cycloalkyl (e.g., cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.), formyl, lower (C₂₋₇) alkanoyl (e.g., acetyl, propionyl, butyryl, etc.), an optionally esterified phosphono group, an optionally esterified carboxyl group, hydroxy group, oxo, etc., and more preferably C₁₋₆ lower alkyl (preferably C₁₋₃ alkyl) hydroxy group, oxo, etc.

[0015] Examples of the optionally esterified phosphono group include a group of the formula: P(O)(OR⁷)(OR⁸) wherein R⁷ and R⁸ are independently hydrogen, a C₁₋₆ alkyl group or a C₃₋₇ cycloalkyl group, and R⁷ and R⁸ may bind to each other to form a 5- to 7-membered ring.

[0016] In the above formula, examples of the C₁₋₆ alkyl group represented by R⁷ and R⁸ include methyl, ethyl, propyl,

isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, etc., and examples of the C₃₋₇ cycloalkyl include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc. Among others, a straight C₁₋₆ lower alkyl is preferable and C₁₋₃ lower alkyl is more preferable. The groups R⁷ and R⁸ may be the same or different, and preferably the groups R⁷ and R⁸ are the same. When R⁷ and R⁸ may bind to each other to form a 5- to 7-membered ring, the groups R⁷ and R⁸ bind to each other to represent a straight C₂₋₄ alkylene chain of the formula: -(CH₂)₂-, -(CH₂)₃-, -(CH₂)₄-, etc. Said chain may have a substituent, and examples of the substituent include hydroxy group, halogen, etc.

[0017] Examples of the optionally esterified carboxyl group include a carboxyl group and an ester group formed by binding a carboxyl group to a C₁₋₆ alkyl group or a C₃₋₇ cycloalkyl group (e.g., methoxycarbonyl, ethoxycarbonyl, propoxycarbonyl, isopropoxycarbonyl, butoxycarbonyl, isobutoxycarbonyl, sec-butoxycarbonyl, tert-butoxycarbonyl, pentyloxycarbonyl, hexyloxycarbonyl, etc.).

[0018] As the group X, an optionally substituted C₁₋₄ alkylene is preferable, C₁₋₄ alkylene which may be substituted with C₁₋₃ alkyl, hydroxy group or oxo is more preferable, and in particular, a group of the formula: -(CH₂)_n- (n is an integer of 1-4) is preferable.

[0019] Examples of the hetero-atom represented by Z¹ and Z² include -O-, -S(O)_m- (m is an integer of 0-2), -N(R⁴)- (R⁴ is a hydrogen atom or an optionally substituted lower alkyl group), etc. As the group Z¹, -O- or -S(O)_m- (m is an integer of 0-2) is preferable, and -O- is more preferable. As the group Z², -O- or -N(R⁴)- (R⁴ is a hydrogen atom or an optionally substituted lower alkyl group) is preferable, and -O- is more preferable.

[0020] Examples of the "optionally substituted lower alkyl group" represented by R⁴ include the same as the above "optionally substituted lower alkyl group" exemplified with respect to the "optionally substituted hydrocarbon group" represented by R.

[0021] Examples of the further substituent, which the "5- to 6-membered ring" of the "5- to 6-membered aromatic ring" which has a group of the formula: R-Z¹-X-Z²- wherein each symbol is as defined above, and which may have a further substituent" represented by R¹ may have, in addition to the group of the formula: R-Z¹-X-Z²-, include a halogen atom, nitro, cyano, an optionally substituted alkyl, an optionally substituted cycloalkyl, an optionally substituted hydroxy group, an optionally substituted thiol group (wherein a sulfur atom may be oxidized to form an optionally substituted sulfinyl group or an optionally substituted sulfonyl group), an optionally substituted amino group, an optionally substituted acyl group, an optionally esterified or amidated carboxyl group, an optionally substituted aromatic group and the like.

[0022] Examples of the halogen as the substituents for R¹ include fluorine, chlorine, bromine, iodine, etc. Among others, fluorine and chlorine are preferable.

[0023] Examples of the alkyl in the optionally substituted alkyl as the substituents for R¹ include a straight or branched C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., and preferably lower (C₁₋₆) alkyl. Examples of the substituents in the optionally substituted alkyl include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), an optionally halogenated C₁₋₄ alkoxy-C₁₋₄ alkoxy (e.g., methoxymethoxy, methoxyethoxy, ethoxyethoxy, trifluoromethoxyethoxy, trifluoroethoxyethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferable 1 to 3.

[0024] Examples of the cycloalkyl in the optionally substituted cycloalkyl as the substituents for R¹ include C₃₋₇ cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc. Examples of the substituents in the optionally substituted cycloalkyl include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0025] Examples of the substituents in the optionally substituted hydroxy group as the substituents for R¹ include

(1) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., preferably lower (C₁₋₆) alkyl, etc.);

- (2) an optionally substituted cycloalkyl which may contain a hetero-atom (e.g., C₃₋₇ cycloalkyl such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.; a saturated 5- to 6-membered heterocyclic ring group containing 1-2 hetero-atoms such as tetrahydrofuranyl, tetrahydrothienyl, pyrrolidinyl, pyrazolidinyl, piperidyl, piperazinyl, morpholinyl, thiomorpholinyl, tetrahydropyranyl, tetrahydrothiopyranyl, etc.; etc., (preferably, tetrahydropyranyl, etc.);
- (3) an optionally substituted alkenyl (e.g., C₂₋₁₀ alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl, etc., preferably lower (C₂₋₆) alkenyl, etc.);
- (4) an optionally substituted cycloalkenyl (e.g. C₃₋₇ cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.);
- (5) an optionally substituted aralkyl (e.g. phenyl-C₁₋₄ alkyl (e.g. benzyl, phenethyl, etc.), etc.);
- (6) formyl or an optionally substituted acyl (e.g. C₂₋₄ alkanoyl (e.g. acetyl, propionyl, butyryl, isobutyryl, etc.), C₁₋₄ alkylsulfonyl (e.g. methanesulfonyl, ethanesulfonyl, etc.), etc.);
- (7) an optionally substituted aryl (e.g. phenyl, naphthyl, etc.); etc.

[0026] Examples of the substituents which the above-mentioned (1) optionally substituted alkyl, (2) optionally substituted cycloalkyl, (3) optionally substituted alkenyl, (4) optionally substituted cycloalkenyl, (5) optionally substituted aralkyl, (6) optionally substituted acyl and (7) optionally substituted aryl may have include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g. amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₆ alkoxy (e.g., trifluoromethoxy, trifluoroethoxy, etc.; preferably an optionally halogenated C₁₋₄ alkoxy), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkoxy, C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), an optionally substituted 5- to 6-membered aromatic heterocyclic ring [e.g., 5- to 6-membered aromatic heterocyclic ring containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from oxygen atom, sulfur atom and nitrogen atom such as furan, thiophene, pyrrole, imidazole, pyrazole, thiazole, oxazole, isothiazole, isoxazole, tetrazole, pyridine, pyrazine, pyrimidine, pyridazine, triazole, etc.; examples of the substituents which said heterocyclic ring may have include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, thiol group, amino group, carboxyl group, an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc.; and the number of the substituents are preferable 1 to 3.], etc., and the number of the substituents are preferably 1 to 3.

[0027] Examples of the substituents in the optionally substituted thiol group as the substituents for R¹ are the same as the above-described substituents of the optionally substituted hydroxy group as the substituents for R¹, and among others,

- (1) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc. preferably lower (C₁₋₆) alkyl, etc.);
- (2) an optionally substituted cycloalkyl (e.g., C₃₋₇ cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.);
- (3) an optionally substituted aralkyl (e.g., phenyl-C₁₋₄ alkyl (e.g. benzyl, phenethyl, etc.), etc.);
- (4) an optionally substituted aryl (e.g., phenyl, naphthyl, etc.); etc. are preferable.

[0028] Examples of the substituents which the above-mentioned (1) optionally substituted alkyl, (2) optionally substituted cycloalkyl, (3) optionally substituted aralkyl and (4) optionally substituted aryl may have include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thio, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0029] Examples of the substituents of the optionally substituted amino group as the substituents for R¹ include an amino group which may have the same one to two substituents as those of the above-described substituents of "the

optionally substituted hydroxy group as the substituents for R^{1a}, etc. Among others,

- (1) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., preferably lower (C₁₋₆) alkyl, etc.);
- (2) an optionally substituted cycloalkyl (e.g., C₃₋₇ cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.);
- (3) an optionally substituted alkenyl (e.g., C₂₋₁₀ alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl, etc., preferably lower (C₂₋₆) alkenyl, etc.);
- (4) an optionally substituted cycloalkenyl (e.g., C₃₋₇ cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.);
- (5) formyl or an optionally substituted acyl (e.g., C₂₋₄ alkanoyl (e.g., acetyl, propionyl, butyryl, isobutyryl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc.);
- (6) an optionally substituted aryl (e.g., phenyl, naphthyl, etc.); etc. are preferable.

[0030] Examples of the substituents, which each of the above-described (1) optionally substituted alkyl, (2) optionally substituted cycloalkyl, (3) optionally substituted alkenyl, (4) optionally substituted cycloalkenyl, (5) optionally substituted acyl and (6) optionally substituted aryl may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5-to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0031] The substituents in the optionally substituted amino group as the substituents for R¹ may bind to each other to form a cyclic amino group (e.g., 5- to 6-membered cyclic amino, etc. such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.). Said cyclic amino group may have a substituent and examples of the substituents include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5-to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0032] Examples of the optionally substituted acyl as the substituents for R¹ include

- (1) hydrogen;
- (2) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, octyl, nonyl, decyl, etc., preferably lower (C₁₋₆) alkyl, etc.);
- (3) an optionally substituted cycloalkyl (e.g., C₃₋₇ cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.);
- (4) an optionally substituted alkenyl (e.g., C₂₋₁₀ alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl, etc., preferably lower (C₂₋₆) alkenyl, etc.);
- (5) an optionally substituted cycloalkenyl (e.g., C₃₋₇ cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.);
- (6) an optionally substituted 5-to 6-membered monocyclic aromatic group (e.g., phenyl, 5- to 6-membered aromatic heterocyclic group (e.g., 5- to 6-membered aromatic heterocyclic group containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from oxygen atom, sulfur atom and nitrogen atom, such as furyl, thienyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, oxazolyl, isothiazolyl, isoxazolyl, tetrazolyl, pyridyl, pyrazyl, pyrimidinyl, pyridazinyl, triazolyl, etc.);
- (7) an optionally substituted 5- to 6-membered monocyclic non-aromatic heterocyclic group (e.g., a group which is formed by removing one hydrogen atom from a 5- to 6-membered monocyclic non-aromatic heterocycle containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from nitrogen atom, sulfur atom and nitrogen atom, such as tetrahydrofuran, tetrahydrothiophene, dioxolane, dithiolane, oxathiolane, pyrrolidine, pyrroline, imidazolidine, imidazoline, pyrazolidine, pyrazoline, piperidine, piperazine, oxazine, oxadiazine, thiazine,

thiadiazine, morpholine, thiomorpholine, pyran, tetrahydropyran, etc.; preferably dioxolanyl, etc) which is bound to a carbonyl group or a sulfonyl group (e.g., acetyl, propionyl, butyryl, isobutyryl, valeryl, isovaleryl, pivaloyl, hexanoyl, butanoyl, octanoyl, cyclobutanecarbonyl, cyclopentanecarbonyl, cyclohexanecarbonyl, cyclobutanecarbonyl, crotonyl, 2-cyclohexenecarbonyl, benzoyl, nicotinyl, methanesulfonyl, ethanesulfonyl, etc.). Examples of the substituents, which the above-mentioned (2) optionally substituted alkyl, (3) optionally substituted cycloalkyl, (4) optionally substituted alkenyl, (5) optionally substituted cycloalkenyl, (6) optionally substituted 5- to 6-membered monocyclic aromatic group and (7) optionally substituted 5- to 6-membered monocyclic non-aromatic heterocycle may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxycarbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), C₁₋₄ alkylenedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, etc.), optionally substituted sulfonamide [e.g., an optionally substituted amino group (e.g. amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.) which is bound to -SO₂-, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0033] Examples of the optionally esterified carboxyl group as the substituents for R¹ include

- (1) hydrogen;
- (2) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., preferably lower (C₁₋₆) alkyl, etc.);
- (3) an optionally substituted cycloalkyl (e.g., C₃₋₇ cycloalkyl, etc. such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, etc.);
- (4) an optionally substituted alkenyl (e.g., C₂₋₁₀ alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl, etc., preferably lower (C₂₋₆) alkenyl, etc.);
- (5) an optionally substituted cycloalkenyl (e.g., C₃₋₇ cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.);
- (6) an optionally substituted aryl (e.g., phenyl, naphthyl, etc.); etc., and preferably carboxyl, lower (C₁₋₆) alkoxy-carbonyl, aryloxy-carbonyl (e.g., methoxycarbonyl, ethoxycarbonyl, propoxycarbonyl, phenoxycarbonyl, naphthoxycarbonyl, etc.), etc.

[0034] Examples of the substituents, which the above-mentioned (2) optionally substituted alkyl, (3) optionally substituted cycloalkyl, (4) optionally substituted alkenyl, (5) optionally substituted cycloalkenyl and (6) optionally substituted aryl may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxycarbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0035] Examples of the optionally amidated carboxyl group as the substituents for R¹ include an carbonyl group binding to "an optionally substituted amino group", etc. which is the same as that of the above-described "optionally substituted amino group as the substituents for R¹", and among others, carbamoyl, mono-C₁₋₆ alkylcarbamoyl, di-C₁₋₆ alkylcarbamoyl, etc. are preferable.

[0036] Examples of the aromatic group in the optionally substituted aromatic group as the substituents for R¹ include 5- to 6-membered aromatic homocyclic or heterocyclic ring such as phenyl, pyridyl, furyl, thienyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, oxazolyl, isothiazolyl, isoxazolyl, tetrazolyl, pyrazinyl, pyrimidinyl, pyridazinyl, triazolyl, oxadiazolyl, thiadiazolyl, etc.; fused aromatic heterocyclic ring such as benzofuran, indole, benzothiophene, benzoxazole, benzothiazole, indazole, benzimidazole, quinoline, isoquinoline, quinoxaline, phthalazine, quinazoline, cinnoline, etc.; etc. Examples of the substituents for these aromatic groups include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), nitro, cyano, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahy-

dropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), an optionally halogenated C₁₋₄ alkyl (e.g., trifluoromethyl, methyl, ethyl, etc.), an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0037] The number of the above-mentioned substituents for R¹ is 1-4 (preferably 1-2) and they may be the same or different and present at any possible position on the ring represented by R¹.

[0038] When the group represented by R binds to the 5- to 6-membered aromatic ring to form a ring, the group of the formula: R-Z¹-X-Z², wherein each symbol is as defined above (as the group R is preferably hydrogen atom) forms a divalent group such as lower (C₁₋₆) alkyleneedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, -O-CH₂-CH₂-CH₂-O-, etc.), oxy-lower (C₁₋₆) alkylene-amino (e.g., -O-CH₂-NH-, -O-CH₂-CH₂-NH-, etc.), oxy-lower (C₁₋₆) alkyleneethio (e.g., -O-CH₂-S-, -O-CH₂-CH₂-S-, etc.), lower (C₁₋₆) alkylene-diamino (e.g., -NH-CH₂-NH-, -NH-CH₂-CH₂-NH-, etc.), thia-lower (C₁₋₆) alkylene-amino (e.g., -S-CH₂-NH-, -S-CH₂-CH₂-NH-, etc.), etc.

[0039] Preferred examples of the further substituent, which the "5- to 6-membered ring" of the "5- to 6-membered aromatic ring which has a group of the formula: R-Z¹-X-Z²" wherein each symbol is as defined above, and which may have a further substituent represented by R¹ may have, in addition to the group of the formula: R-Z¹-X-Z², include, in particular, a lower (C₁₋₄) alkyl optionally substituted with a halogen or a lower (C₁₋₄) alkoxy (e.g., methyl, ethyl, t-butyl, trifluoromethyl, methoxymethyl, propoxymethyl, butoxymethyl, methoxyethyl, ethoxyethoxy, propoxyethyl, butoxyethyl, etc.), a lower (C₁₋₄) alkoxy optionally substituted with a halogen or a lower (C₁₋₄) alkoxy (e.g., poxyethyl, butoxyethyl, etc.), a lower (C₁₋₄) alkoxy optionally substituted with a halogen or a lower (C₁₋₄) alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, t-butoxy, trifluoromethoxy, methoxymethoxy, ethoxymethoxy, propoxymethoxy, butoxymethoxy, methoxyethoxy, ethoxyethoxy, propoxyethoxy, butoxyethoxy, methoxypropoxy, ethoxypropoxy, propoxymethoxy, methoxyethoxy, ethoxyethoxy, propoxyethoxy, butoxyethoxy, methoxypropoxy, ethoxypropoxy, propoxymethoxy, butoxymethoxy, etc.), halogen (e.g., fluorine, chlorine, etc.), nitro, cyano, an amino group optionally substituted with 1-2 lower (C₁₋₄) alkyl groups, formyl group or lower (C₂₋₄) alkanoyl groups (e.g., amino, methylamino, dimethylamino, fromylamino, acethylamino, etc.), 5- to 6-membered cyclic amino (e.g., 1-pyrrolidinyl, 1-piperazinyl, 1-piperidinyl, 4-morpholino, 4-thiomorpholino, 1-imidazolyl, 4-tetrahydropyranyl, etc.), etc.

[0040] When R¹ is a benzene, the "group of the formula: R-Z¹-X-Z²" is preferably present at para position and the further substituent, which the "5- to 6-membered aromatic ring which may have, in addition to the group of the formula: R-Z¹-X-Z², is preferably present at meta position.

[0041] In the above formula, examples of the "optionally substituted imino group" represented by Y include a divalent group of the formula: -N(R⁵)- wherein R⁵ is hydrogen atom or a substituent, etc.

[0042] As R⁵, hydrogen atom, an optionally substituted hydrocarbon group, an optionally substituted heterocyclic group, an optionally substituted hydroxy group, an optionally substituted thiol group (the sulfur atom may be oxidized to form an optionally substituted sulfinyl group or an optionally substituted sulfonyl group), an optionally substituted amino group, an optionally esterified or amidated carboxyl group, and an optionally substituted acyl group, etc. are preferable, and hydrogen atom, an optionally substituted hydrocarbon group, an optionally substituted heterocyclic group and an optionally substituted acyl group, etc. are more preferable.

[0043] As the preferable R⁵, hydrogen atom, an optionally substituted hydrocarbon group, an optionally substituted acyl group, etc. are preferable, C₁₋₄ alkyl, C₁₋₄ alkylsulfonyl, formyl, C₂₋₅ alkanoyl etc. are more preferable, C₁₋₄ alkyl, formyl, C₂₋₅ alkanoyl etc. are further more preferable, and in particular, formyl or ethyl is preferable. As other preferably R⁵, there is a group represented by the formula -(CH₂)_k-R⁶ [wherein k represents 0 or 1, R⁶ represents an optionally substituted 5- to 6-membered monocyclic aromatic group (similar to "6) an optionally substituted 5- to 6-membered monocyclic aromatic group" exemplified with respect to an optionally substituted acyl group as the substituent for R¹; preferably phenyl, pyrazolyl, thiazolyl, oxazolyl, tetrazolyl, etc., each being optionally substituted with halogen, optionally halogenated C₁₋₄ alkyl, optionally halogenated C₁₋₄ alkoxy, etc.)].

[0044] Example of the "optionally substituted hydrocarbon group" as R⁵ are the same as the "optionally substituted hydrocarbon group" of R. Examples of the "optionally substituted heterocyclic group" as R⁵ include the same "optionally substituted heterocyclic group" as the substituent for the "optionally substituted hydrocarbon group", the "optionally substituted thiol group", the "optionally substituted hydroxy group", the "optionally substituted esterified or amidated carboxyl group" and the "optionally substituted acyl group" as R⁵ include the same "optionally substituted hydroxy group", "optionally substituted thiol group", "optionally substituted amino group", "optionally esterified or amidated carboxyl group" and "optionally substituted acyl group" as the substituent for R¹.

[0045] In the above formula (I), examples of the "optionally substituted aliphatic hydrocarbon group" (aliphatic straight chain hydrocarbon group and aliphatic cyclic hydrocarbon group) represented by R² and R³ include

(1) an optionally substituted alkyl (e.g., C₁₋₁₀ alkyl such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isopentyl, neopentyl, hexyl, heptyl, octyl, nonyl, decyl, etc., preferably lower (C₁₋₆) alkyl,

etc.);

(2) an optionally substituted cycloalkyl (e.g., C₃₋₈ cycloalkyl such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, etc.; etc.), provided that

5 (2-1) said cycloalkyl may contain one hetero-atom selected from a sulfur atom, an oxygen atom and a nitrogen atom to form oxirane, thiorane, aziridine, tetrahydrofuran, tetrahydrothiophene, pyrrolidine, tetrahydropyran, tetrahydrothiopyran, tetrahydrothiopyran 1-oxide, piperidine, etc. (preferably, 6-membered ring such as tetrahydropyran, tetrahydrothiopyran, piperidine, etc.); that

10 (2-2) said cycloalkyl may be fused with a benzene ring to form indane, tetrahydronaphthalene, etc. (preferably, indane, etc.); and that

(2-3) said cycloalkyl may have a bridging through a straight chain constituted by 1-2 carbon atoms to form a bridged hydrocarbon residue such as bicyclo[2.2.1]heptyl, bicyclo[2.2.2]octyl, bicyclo[3.2.1]octyl, bicyclo[3.2.2]nonyl, etc., preferably, a cyclohexyl group, etc. having a bridging through a straight chain constituted by 1-2 carbon atoms, and more preferably bicyclo[2.2.1]heptyl, etc.;

15 (3) an optionally substituted alkenyl (e.g., C₂₋₁₀ alkenyl such as allyl, crotyl, 2-pentenyl, 3-hexenyl etc., preferably lower (C₂₋₆) alkenyl, etc.);

(4) an optionally substituted cycloalkenyl (e.g., C₃₋₇ cycloalkenyl, etc. such as 2-cyclopentenyl, 2-cyclohexenyl, 2-cyclopentenylmethyl, 2-cyclohexenylmethyl, etc.); etc.

20 **[0046]** Examples of the substituents, which the above-mentioned (1) optionally substituted alkyl, (2) optionally substituted cycloalkyl, (3) optionally substituted alkenyl and (4) optionally substituted cycloalkenyl may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), an optionally halogenated lower (C₁₋₄) alkyl, an optionally halogenated lower C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), C₁₋₄ alkylenedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), phenyl-lower (C₁₋₄) alkyl, C₃₋₇ cycloalkyl, cyano, nitro, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mono-C₁₋₄ alkylcarbamoyl, di-C₁₋₄ alkylcarbamoyl, etc.), a lower (C₁₋₄) alkoxy-carbamoyl, oxo group (preferably, halogen, an optionally halogenated lower (C₁₋₄) alkyl, an optionally halogenated lower (C₁₋₄) alkoxy, phenyl-lower (C₁₋₄) alkyl, C₃₋₇ cycloalkyl, cyano, hydroxy group, etc.), etc., and the number of the substituents are preferably 1 to 3.

30 **[0047]** Preferred examples of the "optionally substituted aliphatic hydrocarbon group" represented by R² and R³ include (1) a lower (C₁₋₆) straight or branched alkyl which may have 1-3 substituents selected from the class consisting of halogen, cyano, hydroxy group and C₃₋₇ cycloalkyl;

(2) C₅₋₈ cycloalkyl which may be substituted with 1-3 substituents selected from the class consisting of a halogen, an optionally halogenated lower (C₁₋₄) alkyl and a phenyl-lower (C₁₋₄) alkyl, which may contain a hetero-atom selected from the class consisting of a sulfur atom, an oxygen atom and a nitrogen atom, which may be fused with a benzene ring and which may have a bridging through a C₁₋₂ straight chain (e.g., cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, tetrahydropyranyl, tetrahydrothiopyranyl, piperidiny, indanyl, tetrahydronaphthalenyl, piperidiny, indanyl, tetrahydronaphthalenyl, bicyclo[2.2.1]heptyl, etc., each of which may be substituted); etc.

40 **[0048]** In the above formula (I), example of the "optionally substituted alicyclic (non-aromatic) heterocyclic group" represented by R² and R³ include 5- to 6-membered non-aromatic heterocyclic ring containing 1 to 4 hetero-atoms consisting of 1 to 2 kinds of hetero-atoms selected from oxygen atom, sulfur atom and nitrogen atom such as tetrahydrofuran, tetrahydrothiophene, dioxolane, dithiolane, oxathiolane, pyrrolidine, pyrroline, imidazolidine, imidazoline, pyrazolidine, pyrazoline, piperidine, piperazine, oxazine, oxadiazine, thiazine, thiadiazine, morpholine, thiomorpholine, pyran, tetrahydropyran etc. Among others, a 5- to 6-membered non-aromatic heterocyclic ring containing 1 hetero-atom such as tetrahydrofuran, piperidine, tetrahydropyran, tetrahydrothiopyran, etc. and so on are preferable.

50 **[0049]** Examples of the substituent, which the "alicyclic heterocyclic group" in the "optionally substituted alicyclic heterocyclic group" represented by R² and R³ may have, include halogen (e.g., fluorine, chlorine, bromine, iodine, etc.), an optionally halogenated lower (C₁₋₄) alkyl, an optionally halogenated C₁₋₄ alkoxy (e.g., methoxy, ethoxy, propoxy, butoxy, trifluoromethoxy, trifluoroethoxy, etc.), C₁₋₄ alkylenedioxy (e.g., -O-CH₂-O-, -O-CH₂-CH₂-O-, etc.), formyl, C₂₋₄ alkanoyl (e.g., acetyl, propionyl, etc.), C₁₋₄ alkylsulfonyl (e.g., methanesulfonyl, ethanesulfonyl, etc.), phenyl-lower (C₁₋₄) alkyl, C₃₋₇ cycloalkyl, cyano, nitro, hydroxy group, an optionally substituted thiol group (e.g., thiol, C₁₋₄ alkylthio, etc.), an optionally substituted amino group (e.g., amino; mono-C₁₋₄ alkylamino; di-C₁₋₄ alkylamino; 5- to 6-membered cyclic amino such as tetrahydropyrrole, piperazine, piperidine, morpholine, thiomorpholine, pyrrole, imidazole, etc.; etc.), an optionally esterified or amidated carboxyl group (e.g., carboxyl, C₁₋₄ alkoxy-carbonyl, carbamoyl, mo-

no-C₁₋₄alkylcarbonyl, di-C₁₋₄alkylcarbonyl, etc.), a lower (C₁₋₄) alkoxy-carbonyl, oxo group (preferably, halogen, an optionally halogenated lower (C₁₋₄) alkyl, an optionally halogenated lower (C₁₋₄) alkoxy, phenyl-lower (C₁₋₄) alkyl, C₃₋₇ cycloalkyl, cyano, hydroxy group, etc.), etc., and the number of the substituents are preferably 1 to 3.

[0050] Among others, as R², an optionally substituted acyclic hydrocarbon group (e.g., alkyl, alkenyl, etc., each of which may be substituted) is preferable, an optionally substituted lower C₁₋₈ alkyl group is more preferable, and in particular, an optionally substituted methyl group is preferable.

[0051] As R³, an optionally substituted alicyclic hydrocarbon group (e.g., cycloalkyl, cycloalkenyl, etc., each of which may be substituted; preferably, an optionally substituted lower C₃₋₈ cycloalkyl group; and more preferably, an optionally substituted cyclohexyl) or an optionally substituted alicyclic heterocyclic group (preferably, an optionally substituted saturated alicyclic heterocyclic group (preferably, 6-membered ring group); more preferably, an optionally substituted tetrahydropyran-1-yl, an optionally substituted tetrahydrothiopyran-1-yl or an optionally substituted piperidyl; an in particular, an optionally substituted tetrahydropyran-1-yl) is preferable.

[0052] As the compound represented by the above formula (I), 7-(4-ethoxyethoxyphenyl)-1-ethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,

1-ethyl-7-(4-propoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-ethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-ethoxyethoxyphenyl)-1-formyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
1-formyl-7-(4-propoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-formyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-1-propyl-2,3-dihydro-1-benzazepine-4-carboxamide,
N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-1-propyl-2,3-dihydro-1-benzazepine-4-carboxamide,
1-benzyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-cyclopropylmethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-phenyl-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-(3,4-methylenedioxy)phenyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-(2-methyloxazol-5-yl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
1-allyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(3-thienyl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-2-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-(1-methylpyrazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-(3-methylisothiazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-(1-ethylpyrazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(1-methyltetrazol-

5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide,
7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(2-methyltetrazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide etc. are preferable.

5 [0053] Examples of the salts of the compound represented by the formula (I) include a pharmaceutically acceptable salt such as a salt with inorganic base, a salt with organic base, a salt with inorganic acid, a salt with organic acid, a salt with basic or acidic amino acid, etc. Suitable examples of the salt with the inorganic base include a salt with alkali metal (e.g. sodium, potassium, etc.), alkaline earth metal (e.g. calcium, magnesium, etc.), aluminum, ammonium, etc. Suitable examples of the salt with the organic base include a salt with trimethylamine, triethylamine, pyridine, picoline, ethanolamine, diethanolamine, triethanolamine, dicyclohexylamine, N,N'-dibenzylethylenediamine, etc. Suitable examples of the salt with the inorganic acid include a salt with hydrochloric acid, hydrobromic acid, nitric acid, sulfuric acid, phosphoric acid, etc. Suitable examples of the salt with the organic acid include a salt with formic acid, acetic acid, trifluoroacetic acid, fumaric acid, oxalic acid, tartaric acid, maleic acid, citric acid, succinic acid, malic acid, methanesulfonic acid, benzenesulfonic acid, p-toluenesulfonic acid, etc. Suitable examples of the salt with the basic amino acid include a salt with arginine, lysine, ornithine, etc. Suitable examples of the salt with the acidic amino acid include a salt with aspartic acid, glutamic acid, etc. The compound of the formula (I) of the present invention may be hydrated or non-hydrated. When the compound of the formula (I) of the present invention exists as configuration isomer, diastereomer, conformer, etc., it is possible to isolate individual isomers with a per se known separation and purification method, if desired. When the compound of the formula (I) of the present invention is racemate, it can be separated into (S)-isomer and (R)-isomer with usual optical resolution and individual optical isomers and a mixture thereof are included in the scope of the present invention.

20 [0054] The pro-drug of the compound of the formula (I) or a salt thereof of the present invention [hereinafter, referred to as Compound (I) in some cases] means a compound which is converted to Compound (I) under the physiological condition or with a reaction due to an enzyme, an gastric acid, etc. in the living body, that is, a compound which is converted to Compound (I) with oxidation, reduction, hydrolysis, etc. according to an enzyme; a compound which is converted to Compound (I) with hydrolysis by gastric acid, etc.; etc. Examples of the pro-drug of Compound (I) include a compound wherein an amino group of Compound (I) is substituted with acyl, alkyl, phosphoric acid, etc. (e.g. a compound wherein an amino group of Compound (I) is substituted with eicosanyl, alanyl, pentylaminocarbonyl, (5-methyl-2-oxo-1,3-dioxolen-4-yl)methoxycarbonyl, tetrahydrofuranyl, pyrrolidylmethyl, pivaloyloxymethyl, tert-butyl, etc.); a compound wherein a hydroxy group of Compound (I) is substituted with acyl, alkyl, phosphoric acid, boric acid, etc. (e.g. a compound wherein a hydroxy group of Compound (I) is modified with acetyl, palmitoyl, propanoyl, pivaloyl, succinyl, fumaryl, alanyl, dimethylaminomethylcarbonyl, etc.); a compound wherein a carboxyl group of Compound (I) is modified with ester, amide, etc. (e.g. a compound wherein a carboxyl group of Compound (I) is modified with ethyl ester, phenyl ester, carboxymethyl ester, dimethylaminomethyl ester, pivaloyloxymethyl ester, ethoxycarbonyloxyethyl ester, phthalidyl ester, (5-methyl-2-oxo-1,3-dioxolen-4-yl)methyl ester, cyclohexyloxycarbonylethyl ester, methyl amide, etc.); etc. These pro-drugs can be produced by per se known method from Compound (I).

35 [0055] The pro-drug of Compound (I) may be a compound which is converted into Compound (I) under the physiological conditions as described in "Pharmaceutical Research and Development", Vol.7 (Drug Design), pages 163-198 published in 1990 by Hirokawa Publishing Co.

40 [0056] Compound (I) may be labeled with isotope (e.g. ^3H , ^{14}C , ^{35}S , ^{125}I , etc.), etc.

[0057] The present compound of the formula (I) or a salt thereof alone or as an admixture with a pharmaceutically acceptable carrier (e.g. solid formulations such as tablets, capsules, granules, powders, etc.; liquid formulations such as syrups, injections, etc.) may be orally or non-orally (preferably orally) administered.

45 [0058] Examples of non-oral formulations include injections, drops, suppositories, pessaries, etc. In particular, pessary is useful for the prevention of infectious diseases of HIV.

[0059] Examples of the carriers include various organic or inorganic carriers which are generally used in this field. For example, an excipient, a lubricant, a binder, a disintegrating agent, etc. are used in solid formulations, and a solvent, a solubilizer, a suspending agent, an isotonicizing agent, a buffer, a soothing agent, etc. are used in liquid formulations. In addition, if desired, an appropriate additive such as a preservative, an antioxidant, a colorant, a sweetener, etc. may be used. Suitable examples of the excipient include lactose, sucrose, D-mannitol, starch, crystalline cellulose, light silicic acid anhydride, etc. Suitable examples of the lubricant include magnesium stearate, calcium stearate, talc, colloidal silica, etc. Suitable examples of the binder include crystalline cellulose, sucrose, D-mannitol, dextrin, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, polyvinyl-pyrrolidone, etc. Suitable examples of the disintegrating agent include starch, carboxymethyl cellulose, carboxymethyl cellulose calcium, croscarmellose sodium, sodium carboxymethyl starch, etc. Suitable examples of the solvent include water for injection, alcohol, propylene glycol, macrogol, sesame oil, corn oil, etc. Suitable examples of the solubilizer include polyethylene glycol, propylene glycol, D-mannitol, benzyl benzoate, ethanol, trisaminomethane, cholesterol, triethanolamine, sodium carbonate, sodium citrate, etc. Suitable examples of the suspending agent include surfactants such as stearyl triethanolamine, sodium laurylsulfate, lau-

rylamino propionic acid, lecithin, benzalkonium chloride, benzetonium chloride, glycerin monostearate, etc.; hydrophilic polymers such as polyvinylalcohol, polyvinylpyrrolidone, sodium carboxymethyl cellulose, methyl cellulose, hydroxymethyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, etc. Suitable examples of the isotonicizing agent include sodium chloride, glycerin, D-mannitol, etc. Suitable examples of the soothing agent include benzylalcohol, etc. Suitable examples of the preservative include paraoxybenzoic acid esters, chlorobutanol, benzylalcohol phenethylalcohol, dehydroacetic acid, sorbic acid, etc. Suitable examples of the antioxidant include sulfites, ascorbic acid, etc.

[0060] The present invention further provides production methods of the compound of the formula (I) or a salt thereof.

[0061] The compound of the formula (I) or a salt thereof can be produced in accordance with per se known methods, for example, the methods described in JP-A-73476/1996, or analogous methods thereto, etc.

[0062] A salt of the compound of the formulas (II), (III), (IV), (V), (I-1) and (I-2) (hereinafter, abbreviated as Compound (II), Compound(III), Compound(IV), Compound(V), Compound(I-1) and Compound(I-2), respectively, in some cases) may be similar to that of Compound (I).

[0063] In the following reactions, when the starting compounds have, as substituents, amino group, carboxyl group and/or hydroxy group, these groups may be protected by conventional protective groups such as those generally employed in peptide chemistry, etc. After the reaction, if necessary, the protective groups may be removed to obtain the desired compound.

[0064] Examples of an amino-protective group include an optionally substituted C₁₋₆ alkylcarbonyl (e.g., acetyl, propionyl, etc.), formyl, phenylcarbonyl, C₁₋₆ alkyloxycarbonyl (e.g., methoxycarbonyl, ethoxycarbonyl, t-butoxycarbonyl, etc.), phenyloxycarbonyl (e.g., benzoyloxycarbonyl, etc.), C₇₋₁₀ aralkyloxycarbonyl (e.g., benzyloxycarbonyl, etc.), trityl, phthaloyl, etc. These protective groups may be substituted by 1 to 3 substituents such as halogen atom (e.g., fluorine, chlorine, bromine, iodine, etc.), C₁₋₆ alkylcarbonyl (e.g., acetyl, propionyl, butyryl, etc.), nitro group, etc.

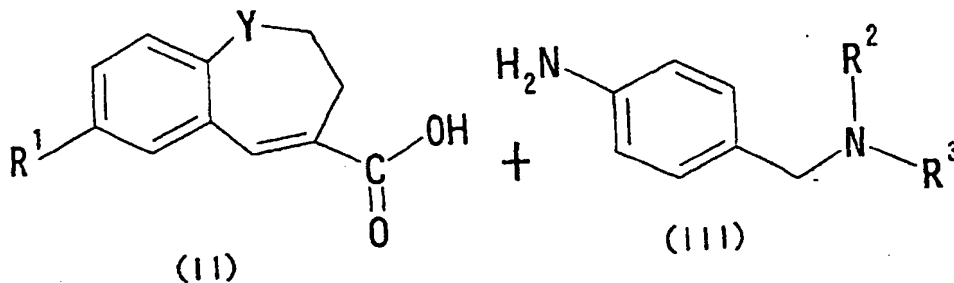
[0065] Examples of a carboxyl-protective group include an optionally substituted C₁₋₆ alkyl (e.g., methyl, ethyl, propyl, isopropyl, butyl, tert-butyl, etc.), phenyl, trityl, silyl, etc. These protective groups may be substituted by 1 to 3 substituents such as halogen atom (e.g., fluorine, chlorine, bromine, iodine, etc.), C₁₋₆ alkylcarbonyl (e.g., acetyl, propionyl, butyryl, etc.), formyl, nitro group, etc.

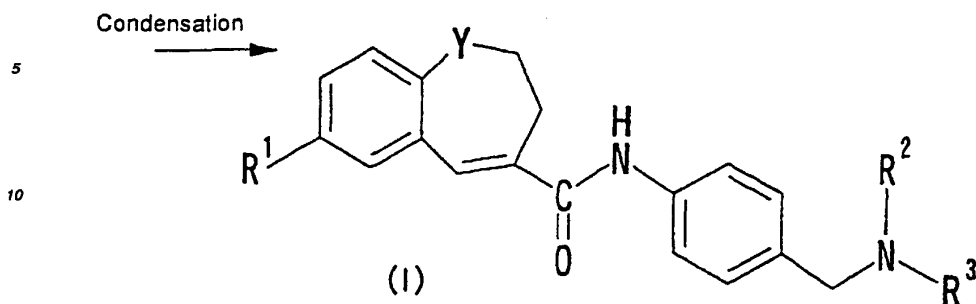
[0066] Examples of a hydroxy-protective group include an optionally substituted C₁₋₆ alkyl (e.g., methyl, ethyl, propyl, isopropyl, butyl, tert-butyl, etc.), phenyl, C₇₋₁₀ aralkyl (e.g., benzyl, etc.), C₁₋₆ alkylcarbonyl (e.g., acetyl, propionyl, etc.), formyl, phenyloxycarbonyl, C₇₋₁₀ aralkyloxycarbonyl (e.g., benzyloxycarbonyl, etc.), pyranil, furanyl, silyl, etc. These protective groups may be substituted by 1 to 4 substituents such as halogen atom (e.g., fluorine, chlorine, bromine, iodine, etc.), C₁₋₆ alkyl, phenyl, C₇₋₁₀ aralkyl, nitro group, etc.

[0067] These protective group may be introduced or removed by per se known methods (e.g. a method described in Protective Groups in Organic Chemistry (J.F.W. McOmie et al.; Plenum Press Inc.). For example, employable method for removing the protective groups is a method using an acid, a base, reduction, ultraviolet ray, hydrazine, phenylhydrazine, sodium N-methyldithiocarbamate, tetrabutylammonium fluoride, palladium acetate, etc.

[Method A]

[0068]





wherein each symbol is as defined above.

[0069] This production method is carried out by reacting Compound (II) with Compound (III) to obtain the anilide Compound (I).

20 [0070] The condensation reaction of Compounds (II) and (III) is carried out by usual methods for peptide synthesis. Said methods for peptide synthesis are employed according to optional known methods, for example, methods described in "Peptide Synthesis" written by M. Bodansky and M. A. Ondetti, Interscience, New York, 1966; "The Proteins", volume 2, written by F. M. Finn and K. Hofmann, H. Nenrath and R. L. Hill edition, Academic Press Inc., New York, 1976; "peptido-gosei no kiso to jikken (Basis and Experiment of Peptide Synthesis)" written by Nobuo Izumiya et al., Maruzen K.K., 1985; etc., as well as azide method, chloride method, acid anhydride method, mixed acid anhydride method, DCC method, active ester method, method using Woodward reagent K, carbonyldiimidazole method, oxidation-reduction method, DCC/HONB method, etc. and in addition WSC method, method using diethyl cyanophosphate (DEPC), etc. The condensation reaction can be carried out in a solvent.

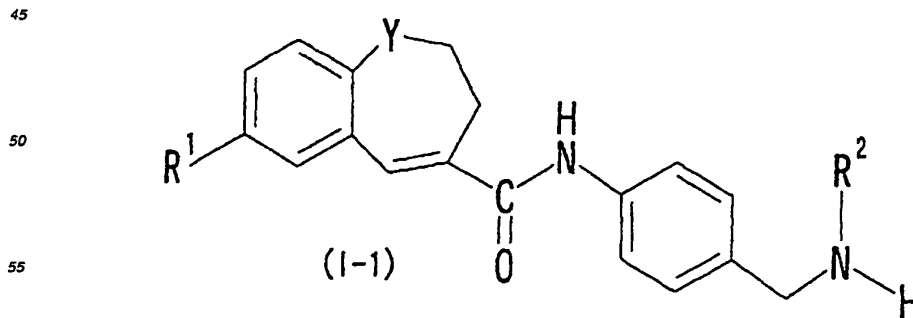
30 [0071] Examples of the solvents to be employed in the reaction include anhydrous or hydrous N,N-dimethylformamide (DMF), dimethyl sulfoxide (DMSO), pyridine, chloroform, dichloromethane, tetrahydrofuran (THF), dioxane, acetonitrile, or a suitable mixture of these solvents.

35 [0072] Usually, about 1-2 moles of the Compound (III) are used per 1 mole of the Compound (II). The reaction temperature is generally about -20°C to about 50°C, preferably about -10°C to about 30°C and the reaction time is generally about 1 to about 100 hours, preferably about 2 to about 40 hours. The thus obtained anilide derivative (I) can be isolated and purified by known separation and purification methods such as concentration, concentration under reduced pressure, extraction, crystallization, recrystallization, solvent convert, chromatography, etc.

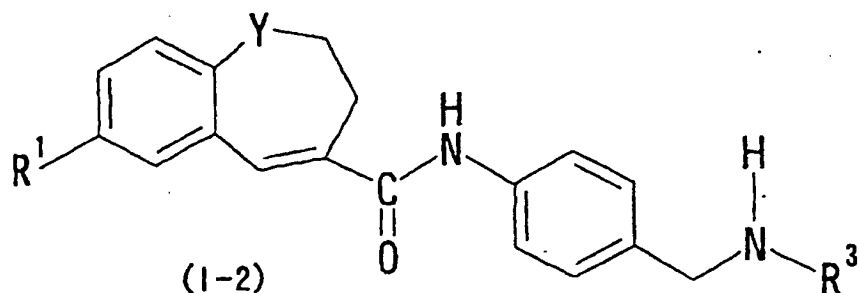
[0073] In addition, the compound of the formula (I) or a salt thereof is a novel compound and useful as an intermediate for producing the compound of the formula (I) or a salt thereof.

40 [Method B]

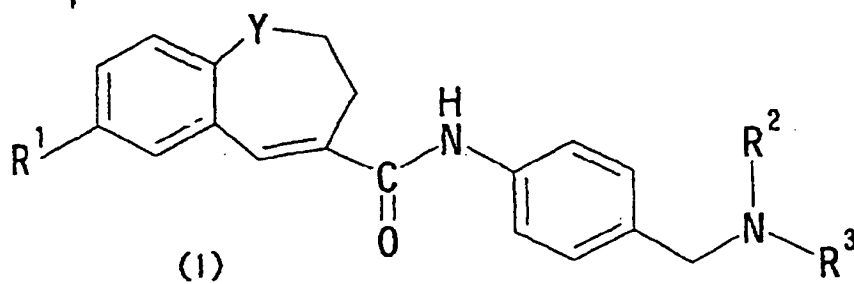
[0074]



or



(1) tertiary amination,
or
(2) reductive amination



(1) Compound (I) can be produced by reacting Compound (I-1) or (I-2) with halogenated alkyl or halogenated aralkyl. Examples of a halogen atom include chlorine, bromine, iodine, etc. and usually about 1 to 2 moles of the halogenated alkyl or halogenated aralkyl is used per mole of Compound (I-1) or (I-2). If necessary, the reaction smoothly proceeds by addition of about once to thrice moles of a base such as triethylamine, diisopropylethylamine, pyridine, lithium hydride, sodium hydride, sodium methoxide, sodium ethoxide, sodium carbonate, potassium carbonate, sodium hydrogen carbonate and further sodium iodide, potassium iodide, etc.

This tertiary amination reaction is carried out in an inert solvent such as methanol, ethanol, propanol, isopropanol, n-butanol, tetrahydrofuran, diethyl ether, dimethoxyethane, 1,4-dioxane, toluene, benzene, xylene, dichloromethane, chloroform, 1,2-dichloroethane, dimethylformamide (DMF), dimethyl sulfoxide (DMSO), pyridine, etc., or a mixture of these solvents. The reaction temperature is generally about 0°C to 180°C, and the reaction time is generally about 1 hour to about 40 hours. This reaction is preferably carried out under inert gas (e.g. nitrogen, argon, etc.) atmosphere.

(2) Compound (I) having a tertiary amino can be produced by reacting Compound (I-1) or (I-2) with an aldehyde compound in the presence of a reductive amination reagent such as triacetoxyborohydride, sodium cyanoborohydride, sodium borohydride, etc. The conditions of this reductive amination reaction vary depending on the reagent to be used. For example, when sodium triacetoxyborohydride is used, reaction is carried out in an inert solvent such as dichloromethane, chloroform, 1,2-dichloroethane, tetrahydrofuran, diethyl ether, dioxane, acetonitrile, dimethylformamide (DMF), etc., or a mixture of these solvents. In this case, about 1 to 2 moles of the reagent is used per mole of Compound (I-1) or (I-2). The reaction temperature is generally about 0°C to about 80°C, and the reaction time is generally about 1 hour to about 40 hours. This reaction is preferably carried out under inert gas (e.g. nitrogen, argon, etc.) atmosphere.

[Method C]

[0075]

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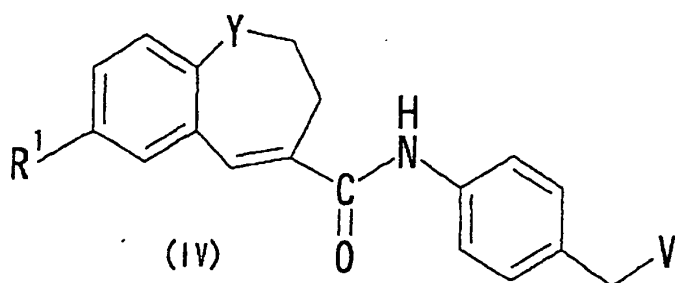
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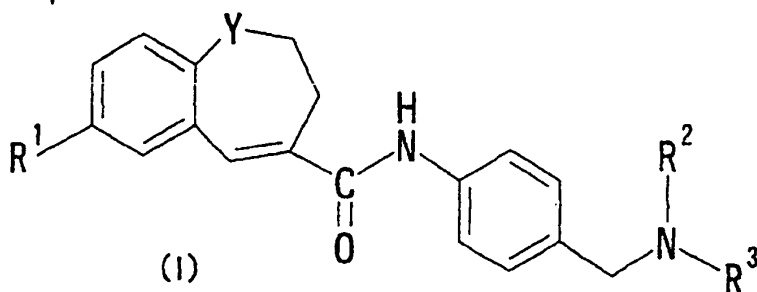
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Substitution



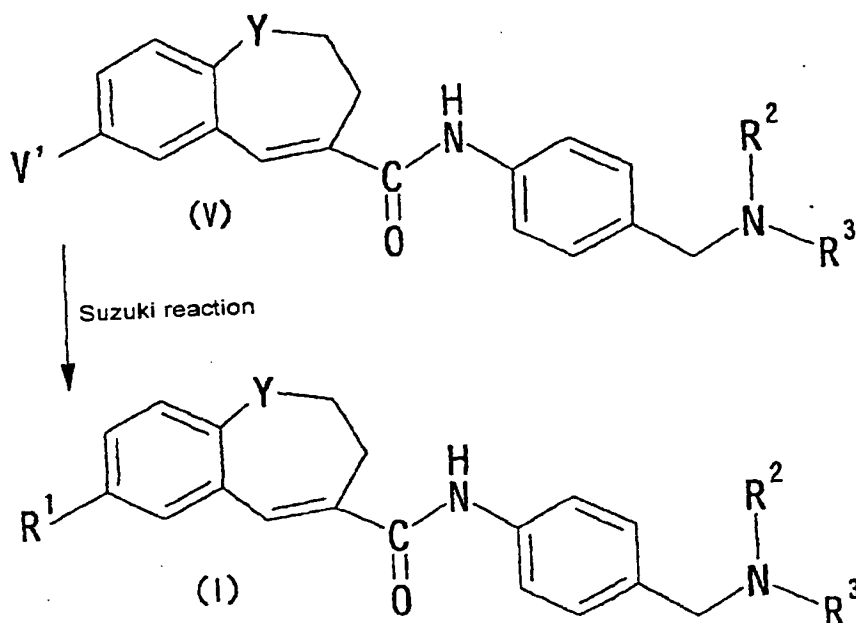
wherein V in the Compound (IV) is a halogen atom (chlorine, bromine, iodine, etc.), or a sulfonyloxy group (methanesulfonyloxy group, trifluoromethanesulfonyloxy group, benzenesulfonyloxy group, toluenesulfonyloxy group, etc.), and the other symbols are as defined above.

[0076] Compound (I) having a tertiary amino group can be produced by reacting Compound (IV) and a secondary amine compound. Usually, about 1 to 3 moles of the secondary amine compound is used per mole of Compound (IV). If necessary, the reaction smoothly proceeds by addition of about once to thrice moles of a base such as triethylamine, diisopropylethylamine, pyridine, lithium hydride, sodium hydride, sodium methoxide, sodium ethoxide, sodium carbonate, potassium carbonate, sodium hydrogen carbonate and further sodium iodide, potassium iodide, etc. This substitution reaction is carried out in an inert solvent such as methanol, ethanol, propanol, isopropanol, n-butanol, tetrahydrofuran, diethyl ether, dimethoxyethane, 1,4-dioxane, toluene, benzene, xylene, dichloromethane, chloroform, 1,2-dichloroethane, dimethylformamide (DMF), dimethyl sulfoxide (DMSO), pyridine, etc., or a mixture of these solvents. The reaction temperature is generally about -10°C to about 180°C , and the reaction time is generally about 1 hour to about 40 hours. The reaction is carried out preferably under inert gas (e.g. nitrogen, argon, etc.) atmosphere.

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[Method D]

[0077]



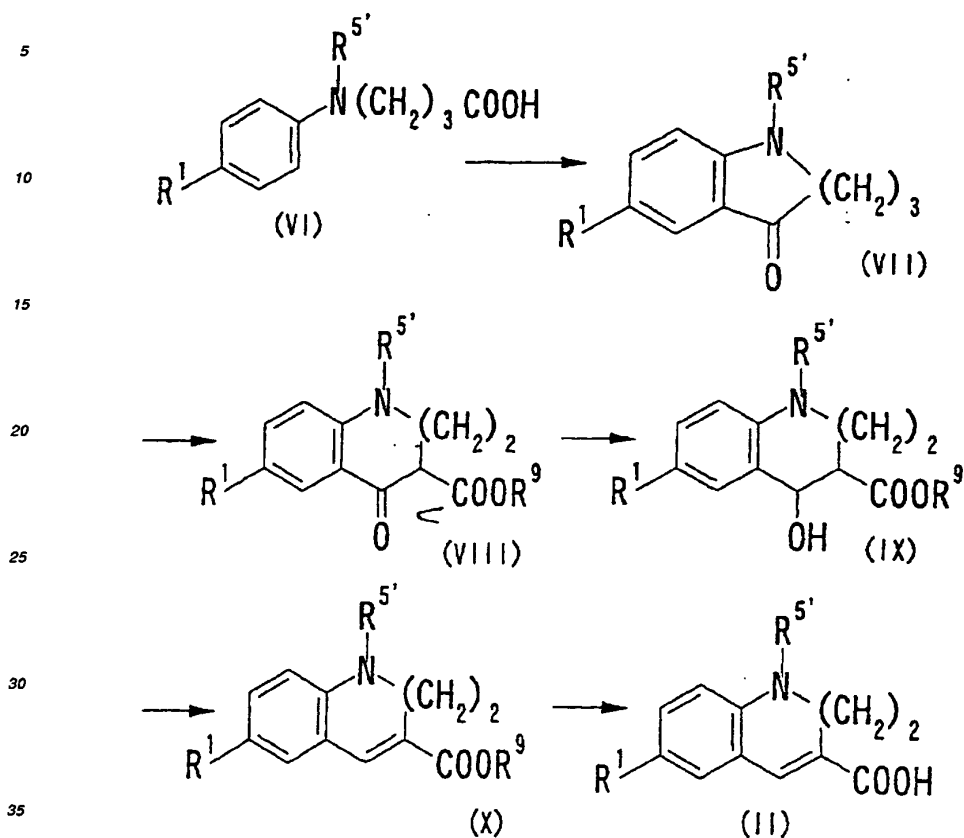
wherein V' in Compound (V) is a halogen atom (bromine, iodine, etc.) or a sulfonyloxy group (trifluoromethanesulfonyloxy group, etc.), and the other symbols are as defined above.

[0078] Compound (I) wherein the group R^1 is a 5- to 6-membered aromatic ring group can be produced by subjecting Compound (V) to, for example, Suzuki reaction [cross condensation reaction of aryl borate with e.g. aryl halide or aryloxytrifluoromethane-sulfonate in the presence of a palladium catalyst; A. Suzuki et al., Synth. Commun. 1981, 111, 513]. Usually, about 1-1.5 times moles of aryl borate is used per mole of Compound (V) to obtain Compound (I).

[0079] The thus obtained Compound (I) can be isolated and purified by known separation and purification methods such as concentration, concentration under reduced pressure, extraction, crystallization, recrystallization, solvent convert, chromatography, etc.

[0080] Compound (II) used as a starting material can be produced by a known method (e.g. method described in JP-A-73476/1996, etc.) or the methods analogous thereto. For example, Compound (II) can be produced by a method described in the following Reaction Scheme I or II, a method described in the following Reference Examples or the methods analogous thereto.

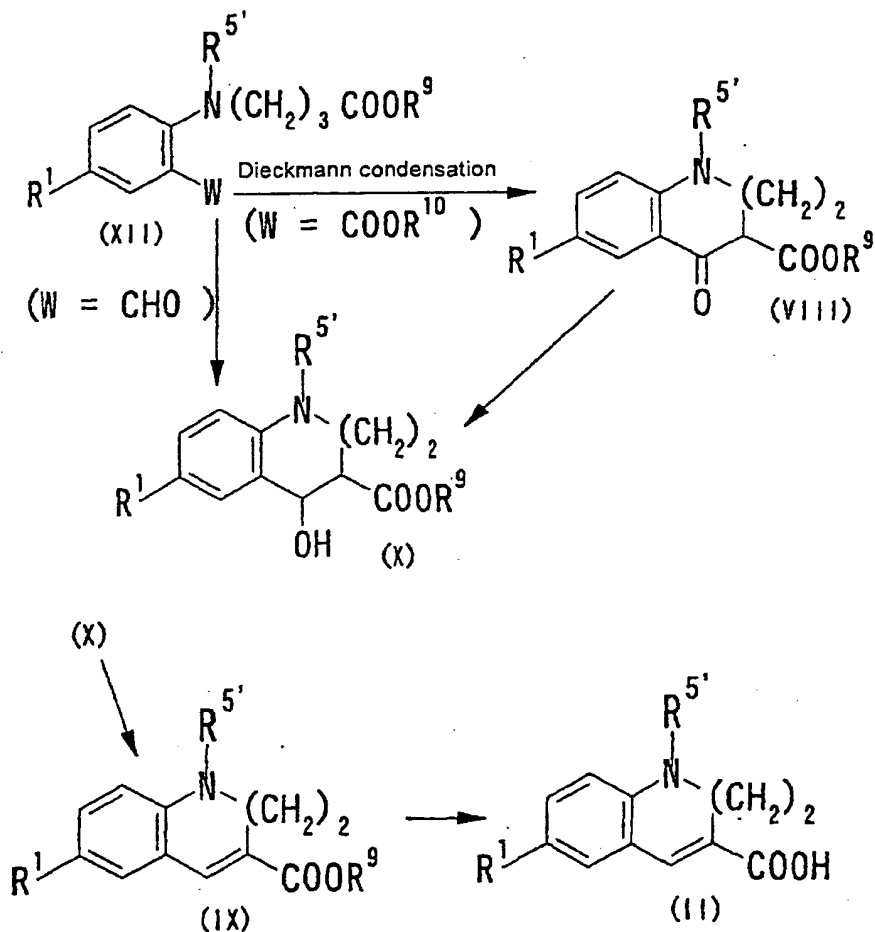
Reaction Scheme I



wherein R^9 is a C_{1-4} alkyl group, $R^{5'}$ has the same meaning as the substituent represented by R^5 , and the other symbols are as defined above.

[0081] In this reaction, the Compound (VI) is heated with polyphosphoric acid, or Compound (VI) is converted to acid chloride with thionyl chloride, oxalyl chloride, phosphorus oxychloride, phosphorus pentachloride, etc., followed by subjecting the resulting acid chloride to usual Friedel-Crafts reaction and cyclizing the same to produce Compound (VII). Compound (VII) is then reacted with carbonate ester in the presence of a base to produce ketoester (VIII). Compound (VIII) is subjected to reduction with catalytic hydrogenation or sodium borohydride, etc. to produce Compound (IX). Compound (IX) is subjected to dehydration by the conventional method to produce Compound (X). Compound (X) is subjected to ester hydrolysis to produce unsaturated carboxylic acid (II).

Reaction Scheme II

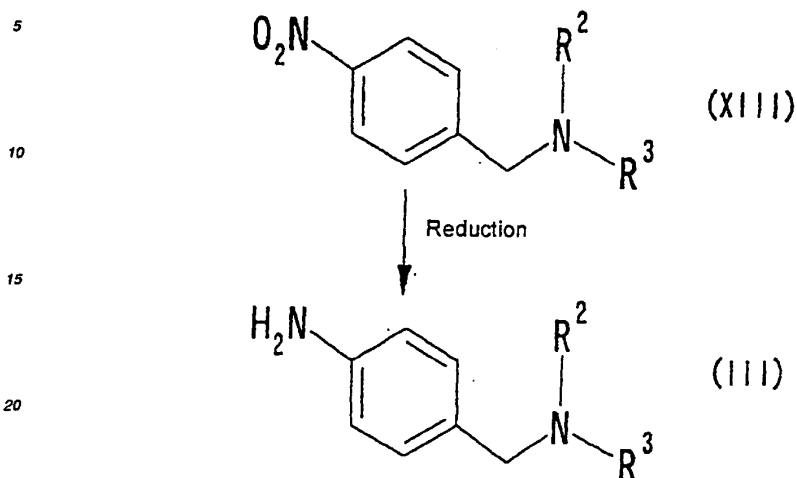


wherein R^{10} is C_{1-4} alkyl group and the other symbols are as defined above.

[0082] The Compound (VIII) or (IX) can be produced by subjecting the Compound (XII) to Dieckmann condensation (J. P. Schaefer and J. J. Bloomfield, Org. Reactions, 1967, 15, 1). Compound (VIII) or (IX) is subjected to the reactions as described in Reaction Scheme I to produce unsaturated carboxylic acid (II).

[0083] Compound (III) can be produced by a known method (e.g. method described in JP-A-73476/1996, etc.) or the methods analogous thereto. For example, Compound (III) can be produced by a method described in the following Reaction Scheme III, a method described in the following Reference Examples or the methods analogous thereto.

Reaction Scheme 111



25 [0084] The reduction of Compound (XIII) can be carried out by per se known methods, for example, reduction with metal, reduction with metal hydride, reduction with metal hydride complex compound, reduction with metal hydride complex compound, reduction with diborane or substituted borane, catalytic hydrogenation, etc. That is, this reaction is carried out by treating Compound (XIII) with a reducing agent. Examples of the reducing agent include metal such as reduced iron, zinc powder, etc.; alkali metal borohydride (e.g., sodium borohydride, lithium borohydride, etc.); metal hydride complex compound such as aluminum lithium hydride, etc.; metal hydride such as sodium hydride etc.; organic tin compound (triphenyltin hydride, etc.), metal complex compound and metal salt such as nickel compound, zinc compound etc.; catalytic reducing agent using hydrogen and transition metal catalyst such as palladium, platinum, rhodium, etc.; diborane; etc. Among others, as the reducing agent, catalytic reducing agent using hydrogen and transition metal catalyst such as palladium, platinum, rhodium, etc.; metal such as reduced iron, etc. are preferable. The reaction is carried out in a solvent which does not affect the reaction. Examples of the solvent include benzene, toluene, xylene, chloroform, carbon tetrachloride, dichloromethane, 1,2-dichloroethane, 1,1,2,2-tetrachloroethane, diethyl ether, tetrahydrofuran, dioxane, methanol, ethanol, propanol, isopropanol, 2-methoxyethanol, N,N-dimethylformamide, acetic acid, or a mixture of these solvents, etc. The solvent is appropriately selected depending on kind of the reducing agent. The reaction temperature is generally about -20°C to about 150°C, preferably about 0°C to about 100°C, and the reaction time is generally about 1 to about 24 hours.

40 [0085] The thus resulted Compound (II) or (III) can be separated and purified with know separation and purification methods such as concentration, concentration under reduced pressure, extraction, crystallization, solvent conversion, chromatography, etc.

45 [0086] The compound of the formula (I) or a salt thereof of the present invention may be used in combination with other drug for the treatment or prevention of infectious diseases of HIV (in particular, a pharmaceutical composition for the treatment or prevention of AIDS). In this case, these drugs can be formulated by mixing individually or simultaneously with pharmaceutically acceptable carriers, excipients, binders, diluents or the like, which can be administered orally or non-orally as a pharmaceutical composition for the treatment or prevention of infectious diseases of HIV. In the case of formulating these effective components individually, while the individually formulated agents can be administered in the form of their mixture prepared by using e.g. a diluent when administered, the individually formulated agents can also be administered separately or simultaneously or with time intervals to the one and same subject. A kit for administering the individually formulated effective components in the form of their mixture prepared by using e.g., a diluent when administered (e.g., a kit for injection which comprises two or more ampoules each comprising a powdery component and a diluent for mixing and dissolving two or more components when administered, etc.), a kit for administering the individually formulated agents simultaneously or with time intervals to the one and the same subject (e.g., a kit for tablets to be administered simultaneously or with time intervals, characterized by having two or more tablets each comprising an agent and said tablets being put in one or separate bags and, if necessary, a column to describe time to be administered each agent, etc.), etc. are also included by the pharmaceutical composition of the

present invention.

[0087] Example of the other pharmaceutical agent for the treatment or prevention of infectious disease of HIV to be used in combination with the compound of the formula (I) or a salt thereof of the present invention include nucleotide reverse transcriptase inhibitors such as zidovudine, didanosine, zalcitabine, lamivudine, stavudine, abacavir, adefovir, adefovir dipivoxil, fozivudine tidoxil, etc.; non-nucleotide reverse transcriptase inhibitors (including an agent having antioxidation activity such as immunocal, oltipraz, etc.) such as nevirapine, delavirdine, efavirenz, loviride, immunocal, oltipraz, etc.; protease inhibitors such as saquinavir, ritonavir, indinavir, nelfinavir, amprenavir, palinavir, lasinavir, etc.; etc.

[0088] As the nucleotide reverse transcriptase inhibitor, zidovudine, didanosine, zalcitabine, lamivudine, stavudine, etc. are preferable; as the non-nucleotide reverse transcriptase inhibitor, nevirapine, delavirdine etc. are preferable; and as the protease inhibitor, saquinavir, ritonavir, indinavir, nelfinavir etc. are preferable.

[0089] The compound of the formula (I) or a salt thereof of the present invention may be used in combination with, for example, CXCR4 antagonist (CXCR4 being a second receptor of T cell-tropic HIV-1) such as AMD-3100, etc., antibody against HIV-1 surface antigen. HIV-1 vaccine, etc., in addition to the above-mentioned protease inhibitor, nucleotide reverse transcriptase inhibitor, etc.

[0090] The compound of the formula (I) or a salt thereof of the present invention has CC chemokine receptor (CCR) antagonistic activity, in particular, potent CCR5 antagonistic activity and, therefore, can be used for the treatment or prevention of various infectious diseases of HIV, for example, AIDS in human. The compound of the formula (I) or a salt thereof of the present invention is low toxic and safely used.

[0091] The compound of the formula (I) or a salt thereof of the present invention can be used as CCR5 antagonist for the treatment or prevention of AIDS and also for the prevention of the progression of the AIDS.

[0092] The dose per day of the compound of the formula (I) or a salt thereof varies depending on the condition and body weight of a patient, administration route, etc. Typical daily dose per adult patient (body weight: 50Kg) for oral administration is about 5-1000mg, preferably about 10-600mg, more preferably about 10-300mg, and in particular about 15-150mg, as active ingredient [the compound of the formula (I) or a salt thereof] and the compound of the formula (I) or a salt thereof is administered once or 2-3 times per day.

[0093] When the compound of the formula (I) or a salt thereof is used in combination with a reverse transcriptase inhibitor and/or a protease inhibitor. The dose of the reverse transcriptase inhibitor or the protease inhibitor ranges, for example, from about 1/200-1/2 or more of usual dose to about 2-3 times or less of usual dose. In case that two or more drugs are used in combination, each dose of the drugs is appropriately adjusted if one drug affects metabolism of the other drug, while each dose of the drugs when they are used in combination is generally the same as the dose when they are used alone.

[0094] Usual doses of the typical reverse transcriptase inhibitors and the protease inhibitors are as follows:

35 zidovudine : 100mg
 didanosine : 125-200mg
 zalcitabine : 0.75mg
 lamivudine : 150mg
 stavudine : 30-40mg
 40 saquinavir : 600mg
 ritonavir : 600mg
 indinavir : 800mg
 nelfinavir : 750mg

45 [0095] In case of combination use of the compound of the formula (I) or a salt thereof with a reverse transcriptase inhibitor and/or a protease inhibitor, preferred embodiments are shown below.

50 (1) A drug containing about 10-300mg of the compound of the formula (I) or a salt thereof and a drug containing about 50-200mg of zidovudine to one adult patient (body weight: 50Kg) are administered. Each of the drugs may be administered to the one and the same subject simultaneously or with time intervals of 12 hours or less.

 (2) A drug containing about 10-300mg of the compound of the formula (I) or a salt thereof and a drug containing about 300-1200mg of saquinavir to one adult patient (body weight: 50Kg) are administered. Each of the drugs may be administered to the one and the same subject simultaneously or with time intervals of 12 hours or less.

55 Best Mode for Carrying out the Invention

[0096] The present invention is hereinafter described in more detail by means of the following Test Example. Formulation Example, Reference Examples and Working Examples, which are mere examples of the present invention

and are not construed as limitative to the present invention.

[0097] The following gene manipulation is carried out in accordance with methods described in textbook (Maniatis et al., Molecular Cloning, Cold Spring Harbor Laboratory, 1989) or protocol attached to reagents.

5 Examples

Test Example

(1) Cloning of human CCR5 chemokine receptor

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[0098] Cloning of CCR5 gene was carried out by a PCR method from human spleen cDNA. With using 0.5ng of spleen cDNA (Toyobo, QUICK-Clone cDNA) as template, PCR was performed in DNA Thermal Cycler 480 (Perkin-Elmer) (reaction conditions: 30 cycles of 95°C for 1 minute, 60°C for 1 minute, and 75°C for 5 minutes) by adding each 25 pmol of primers of a primer set,

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SEQ ID NO.: 1 described in Test Example (1) of WO 99/32100 [length of sequence: 34; type of sequence: nucleic acid; strandedness: single; topology: straight; kind of sequence: other nucleic acid synthetic DNA, and SEQ ID NO.: 2 described in Test Example (1) of WO 99/32100 [length of sequence: 34; type of sequence: nucleic acid; strandedness: single; topology: straight; kind of sequence: other nucleic acid synthetic DNA which were designed referring to nucleotide sequence of CCR5 gene reported by Samson et. al. (Biochemistry, 35(11), 3362-3367 (1996)) and by using TaKaRa EX Taq (Takara Shuzo). The resultant PCR product was subjected to agarose gel electrophoresis to collect about 1.0kb DNA fragment, which was subjected to Original TA Cloning Kit (Funakoshi) to carry out cloning of CCR5 gene.

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25 (2) Preparation of plasmid for expression of human CCR5

[0099] The plasmid obtained in the above (1) was digested with restriction enzymes XbaI (Takara Shuzo) and BamHI (Takara Shuzo) and subjected to agarose gel electrophoresis to collect about 1.0kb DNA fragment.

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[0100] The DNA fragment was mixed with plasmid pcDNA3.1 (Funakoshi) for expression in animal cells, said plasmid being digested with XbaI and BamHI, and they were ligated with DNA Ligation Kit Ver.2 (Takara Shuzo). The resulting plasmid was subjected to transformation of competent cell of E. coli JM109 (Takara Shuzo) to obtain plasmid pCKR5.

(3) Introduction of plasmid for expression of human CCR5 into CHO-K1 cell and Expression of said plasmid in CHO-K1 cell

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[0101] CHO-K1 cells were grown in 750ml of tissue culture flask (Becton Dickinson) using Ham's F12 medium (Nihon Pharmaceutical) containing 10% fetal calf serum (Life Tech Oriental) and took off with 0.5g/L trypsin-0.2g/L EDTA (Life Tech Oriental). The cells were washed with PBS (Life Tech Oriental), centrifuged (1000rpm, 5 minutes), and suspended in PBS. With using Gene Pulser (Bio-Rad Laboratories), DNA was introduced into the cells under the conditions shown below. That is, to the cuvette of 0.4cm gap were added 8×10^6 cells and 10 μ g of plasmid pCKR5 for expression of human CCR5, and electroporation was carried out under 0.25kV of voltage and 960 μ F of capacitance. The cells were transferred into Ham's F12 medium containing 10% fetal calf serum, and cultivated for 24 hours. The cells were again took off and centrifuged, and suspended in Ham's F12 medium containing 10% fetal calf serum and 500 μ g/ml of geneticin (Life Tech Oriental). The suspension was diluted to give 104 cells/ml of the suspension, which was inoculated

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on 96 well plate (Becton Dickinson) to give geneticin resistant cells. [0102] The resulting geneticin resistant cells were cultivated in 96 well plate (Becton Dickinson), and cells expressing CCR5 were selected from the geneticin resistant cells. That is, in assay buffer (Ham's F12 medium containing 0.5% BSA and 20mM HEPES (Wako Pure Chemical, pH7.2)) to which was added 200pM of [¹²⁵I]-RANTES (Amersham) as a ligand, a binding reaction was carried out at room temperature for 40 minutes, and the buffer was washed with cooled PBS. To the buffer was added 50 μ l/well of 1M NaOH, and the mixture was stirred. Radioactivity was determined with a γ -counter to select CCR5/CHO cells which specifically bind to the ligand.

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(4) Evaluation of Test Compounds based on CCR5 antagonistic activity

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[0103] The CCR5/CHO cells were inoculated on 96 well microplate (5×10^4 cells/well) and cultivated for 24 hours. The medium was removed by means of suction, and to each well was added an assay buffer containing Test Compound (1 μ M) and then 100pM of [¹²⁵I]-RANTES (Amersham) as a ligand. A binding assay was carried out at room temperature for 40 minutes, and an assay buffer was removed by means of suction. Each well was washed twice with cooled PBS,

and 200 μ l of Microscint-20 (Packard Instrument, Inc.) was added to each well. Radio-activity was determined with Top-Count Micro Scintillation Counter (Packard Instrument, Inc.).

[0104] According to the method described above, inhibitory rate of Test Compound to CCR5 binding was measured. The results are shown in Table 1.

Table 1

Compound Number	Inhibitory Rate (%)
1	93
2	96
14	96
16	96
17	99
19	100
20	94
23	97
26	100
27	100
33	98
35	100
39	98
43	100
45	100
49	100
50	100
58	99
68	95
69	100
71	100
77	97
79	100
84	97
85	100
98	100
101	100
102	100
104	98
112	100

(5) Inhibitory effect on HIV-1 infection to MAGI-CCR5 cell

[0105] The plasmid where β -galactosidase gene was ligated downstream of HIV-1 LTR was introduced into CD4 positive HeLa cell, to which human CCR5 was further introduced to obtain transformant MAGI-CCR5.

[0106] By using said transformant MAGI-CCR5, a degree of HIV-1 infection was calculated using β -galactosidase activity (blue color due to decomposition of 5-bromo-4-chloro-3-indolyl- β -D-galactopyranoside) as an index. Specifically, MAGI-CCR5 cells were suspended in DMEM medium containing 10% serum to prepare 5×10^4 cells/ml suspension. To each well of 96 well plate was inoculated 200 μ l of the suspension, and the cells were cultivated at 37°C overnight. The medium was removed by means of suction, and to the residue was added 100 μ l of the above medium containing 1.6 μ M of Test Compound and 100 μ l of the above medium containing 300PFU of HIV-1 BA-L cells. The cells were cultivated at 37°C for 2 days. The medium was removed by means of suction. To the residue was added 200 μ l of a cell fixative (PBS containing 1% formaldehyde and 0.2% glutaraldehyde), and the mixture was allowed to stand at room temperature for 5 minutes and washed twice with PBS. To the mixture was added 100 μ l of staining solution (PBS containing 4 μ M potassium ferrocyanide, 4 μ M potassium ferricyanide, 2 μ M $MgCl_2$ and 0.4mg/ml X-gal), and the mixture was allowed to stand at 37°C for 50 minutes and washed twice with PBS. The number of blue cells was counted by a microscope and defined as the number of cells infected with HIV-1. According to this method, inhibition rate on

HIV-1 infection was determined. The results are shown in Table 2.

Table 2

Compound Number	Inhibition Rate (%)
1	85
14	91
16	94
17	94

[0107] The pharmaceutical composition for antagonizing CCR5 (e.g., a medicament for the treatment or prevention of infectious disease of HIV, a medicament for the treatment or prevention of AIDS, etc.) comprising the compound of the formula (I) or a salt thereof of the present invention, as an active ingredient, can be prepared, for example, by the following prescriptions:

Formulation Example

1. Capsule

[0108]

- (1) Compound obtained in Working Example 1 40mg
- (2) lactose 70mg
- (3) fine crystalline cellulose 9mg
- (4) magnesium stearate 1mg
- 1 capsule 120mg

(1), (2), (3) and 1/2 of (4) are mixed and then granulated. To the granules is added the remainder of (4), and the whole is filled into a gelatin capsule.

2. Tablet

[0109]

- (1) Compound obtained in Working Example 1 40mg
- (2) lactose 58mg
- (3) corn starch 18mg
- (4) fine crystalline cellulose 3.5mg
- (5) magnesium stearate 0.5mg
- 1 capsule 120mg

(1), (2), (3), 2/3 of (4) and 1/2 of (5) are mixed and then granulated. To the granules are added the remainders of (4) and (5), followed by subjecting the mixture to compression molding.

Reference Example 1

[0110] In DMF (14ml) was dissolved 1-formyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.18g). To the solution was added, under ice-cooling, thionyl chloride (0.1ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (50ml). The suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.13g) and triethylamine (0.33ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature for 2 hours. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethanol/hexane to give 1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.16g) as colorless crystals.

mp 234 - 243°C.

¹H-NMR (δ ppm, CDCl₃) 1.70 - 1.75 (4H, m), 2.21 (3H, s), 2.60 - 2.67 (1H, m), 3.03 (2H, t, J = 5.4 Hz), 3.21 - 3.26 (4H, m), 3.37 (2H, dt, J = 2.8, 11.2 Hz), 3.58 (2H, s), 3.87 - 3.95 (6H, m), 4.02 - 4.07 (2H, m), 7.00 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.6 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.47 - 7.59 (7H, m), 7.69 (1H, d, J = 2.2 Hz), 8.55 (1H, s). IR (KBr) ν: 2953, 2845, 1667 cm⁻¹.

Anal. Calcd. for C₃₅H₄₀N₄O₄: C, 72.39; H, 6.94; N, 9.65. Found C, 72.03; H, 6.65; N, 9.49.

Reference Example 2

[0111] In DMF (5ml) was dissolved 7-(4-ethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g). To the solution was added, under ice-cooling, thionyl chloride (0.11ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (15ml). The suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.15g) and triethylamine (0.41ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-(4-ethoxyphenyl)-1-formyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.25g) as colorless crystals.

mp 211 - 215°C.

¹H-NMR (δ ppm, CDCl₃) 1.45 (3H, t, J = 6.9 Hz), 1.59 - 1.75 (4H, m), 2.21 (3H, s), 2.60 - 2.68 (1H, m), 3.04 (2H, t, J = 5.5 Hz), 3.37 (2H, dt, J = 2.8, 11.3 Hz), 3.58 (2H, s), 3.93 (2H, t, J = 5.5 Hz), 4.01 - 4.18 (4H, m), 6.99 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.6 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.46 - 7.58 (6H, m), 7.68 (1H, d, J = 2.0 Hz), 8.55 (1H, s). IR (KBr) ν: 2940, 1667 cm⁻¹.

Anal. Calcd. for C₃₃H₃₇N₃O₄·0.2H₂O: C, 72.96; H, 6.94; N, 7.73. Found C, 72.89; H, 6.91; N, 7.59.

Reference Example 3

[0112] In DMF (5ml) was dissolved 7-(3-diethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). To the solution was added, under ice-cooling, thionyl chloride (0.12ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (25ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.16g) and triethylamine (0.46ml) in THF (4ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature for 5 hours. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/diethyl ether to give 7-(3,4-diethoxyphenyl)-1-formyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.26g) as yellow crystals.

mp 145 - 148°C.

¹H-NMR (δ ppm, CDCl₃) 1.49 (3H, t, J = 7.0 Hz), 1.50 (3H, t, J = 7.0 Hz), 1.62 - 1.75 (4H, m), 2.21 (3H, s), 2.61 - 2.70 (1H, m), 3.04 (2H, t, J = 5.4 Hz), 3.38 (2H, dt, J = 3.0, 11.2 Hz), 3.58 (2H, s), 3.93 (2H, t, J = 5.4 Hz), 3.95-4.10 (2H, m), 4.10 - 4.24 (4H, m), 6.97 (1H, d, J = 8.8 Hz), 7.11 - 7.21 (3H, m), 7.33 (2H, d, J = 8.4 Hz), 7.49 - 7.59 (4H, m), 7.68 (1H, d, J = 2.0 Hz), 8.55 (1H, s).

IR (KBr) ν: 2980, 2944, 1667 cm⁻¹.

Anal. Calcd. for C₃₅H₄₁N₃O₅·0.2H₂O: C, 71.58; H, 7.10; N, 7.15. Found C, 71.40; H, 7.00; N, 7.22.

Reference Example 4

[0113] In DMF (10ml) was dissolved 1-methanesulfonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.3g). To the solution was added, under ice-cooling, thionyl chloride (0.15ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (50ml). The suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.19g) and triethylamine (0.5ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/ethanol to give 1-methanesulfonyl-N-[4-[N-methyl-N-(tetrahydro-

2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.26g) as pale crystals.

mp 239 - 243°C.

¹H-NMR (δ ppm, CDCl₃) 1.70 - 1.77 (4H, m), 2.22 (3H, s), 2.60 - 2.70 (1H, m), 2.89 (3H, s), 3.13 (2H, t-like), 3.21 - 3.26 (4H, m), 3.37 (2H, dt, J = 2.6, 11.5 Hz), 3.59 (2H, s), 3.87 - 3.91 (6H, m), 4.02 - 4.11 (2H, m), 7.00 (2H, d, J = 8.8 Hz), 7.34 (2H, d, J = 8.8 Hz), 7.50 - 7.66 (9H, m).

IR (KBr) ν: 2951, 2847, 1661, 1609, 1520 cm⁻¹.

Anal. Calcd. for C₃₅H₄₂N₄O₅S·0.3H₂O: C, 66.08; H, 6.75; N, 8.81. Found C, 66.06; H, 6.50; N, 8.55.

10 Reference Examples 5

[0114] In DMF (12ml) was suspended 7-(4-ethoxyphenyl)-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.13g). To the suspension was added, under ice-cooling, thionyl chloride (0.04ml) and DMF (catalytic amount), and the mixture was stirred at room temperature for 2 hours. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (15ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.08g) and triethylamine (0.14ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-(4-ethoxyphenyl)-1-methanesulfonyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.16g) as colorless crystals.

mp 184 - 186°C.

¹H-NMR (δ ppm, CDCl₃) 1.45 (3H, t, J = 7.0 Hz), 1.64 - 1.75 (4H, m), 2.21 (3H, s), 2.61 - 2.72 (1H, m), 2.88 (3H, s), 3.13 (2H, t, J = 5.3 Hz), 3.37 (2H, dt, J = 2.6, 11.2 Hz), 3.59 (2H, s), 3.91 (2H, t, J = 5.3 Hz), 4.01 - 4.07 (2H, m), 4.09 (2H, q, J = 7.0 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.33 (2H, d, J = 8.8 Hz), 7.48 - 7.68 (9H, m).

IR (KBr) ν: 2946, 2843, 1661, 1609, 1518, 1495 cm⁻¹.

Anal. Calcd. for C₃₃H₃₉N₃O₅S: C, 67.21; H, 6.67; N, 7.13. Found C, 67.25; H, 6.33; N, 7.05.

30 Reference Example 6

[0115] In DMF (8ml) was dissolved 1-methoxycarbonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.15g). To the solution was added, under ice-cooling, thionyl chloride (0.07ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (25ml). The suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.12g) and triethylamine (0.26ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature for 4 hours. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (elution solvent: methanol/triethylamine/ethyl acetate) to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 1-methoxycarbonyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.14g) as colorless crystals.

mp 193 - 197°C.

¹H-NMR (δ ppm, CDCl₃) 1.57 - 1.80 (4H, m), 2.21 (3H, s), 2.65 (1H, br), 3.03 (2H, br), 3.20 - 3.23 (4H, m), 3.37 (2H, dt, J = 3.0, 9.9 Hz), 3.58 (2H, s), 3.78 (3H, s), 3.78 (2H, br), 3.87 - 3.92 (4H, m), 4.01 - 4.14 (2H, m), 6.99 (2H, d, J = 9.2 Hz), 7.30 - 7.60 (10H, m).

IR (KBr) ν: 2957, 2855, 1701 cm⁻¹.

Anal. Calcd. for C₃₆H₄₂N₄O₅·0.2H₂O: C, 70.38; H, 6.96; N, 9.12. Found C, 70.35; H, 6.81; N, 9.09.

50 Reference Example 7

[0116] In a mixture of water: ethanol: toluene (1:1:10, v/v, 18.0ml) were dissolved 3,4-diethylphenyl borate (264mg) and 7-bromo-1-methyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (406mg), and to the solution was added potassium carbonate (162mg). The mixture was stirred under argon atmosphere at room temperature for 30 minutes, and to the mixture was added tetrakis(triphenylphosphine)palladium (39mg). The mixture was refluxed under argon atmosphere for 13 hours, diluted with ethyl acetate and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate.

The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (45g, ethyl acetate : ethanol = 20 : 1) and recrystallized from ethanol to give 7-(3,4-diethylphenyl)-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (263mg, 55%) as yellow crystals.

mp 127 - 129°C.
¹H-NMR (200 MHz, CDCl₃) δ 1.47 (3H, t, J = 7.0 Hz), 1.48 (3H, t, J = 7.0 Hz), 1.69 - 1.76 (4H, m), 2.21 (3H, s), 2.53 - 2.74 (1H, m), 2.96 (2H, t, J = 4.5 Hz), 3.09 (3H, s), 3.31 - 3.43 (4H, m), 3.57 (2H, s), 4.01 - 4.07 (2H, m), 4.13 (2H, q, J = 7.0 Hz), 4.17 (2H, q, J = 7.0 Hz), 6.87 (1H, d, J = 8.6 Hz), 6.93 (1H, d, J = 9.0 Hz), 7.07 (1H, dd, J = 6.9, 2.1 Hz), 7.09 (1H, s), 7.30 (2H, d, J = 8.6 Hz), 7.41 - 7.42 (2H, m), 7.48 (1H, dd, J = 9.1, 2.3 Hz), 7.54 (2H, d, J = 8.6 Hz), 7.59 (1H, s).
 IR (KBr) 1653, 1599, 1514, 1503, 1478, 1406, 1312, 1246, 1188, 1140, 1044 cm⁻¹.
 Anal. Calcd. for C₃₅H₄₃N₃O₄: C, 73.78; H, 7.61; N, 7.38. Found C, 73.49; H, 7.54; N, 7.15.

Reference Example 8

[0117] In a mixture of THF and ethanol (1 : 1, v/v, 30.0ml) was dissolved ethyl 1-[(4-methylphenyl)sulfonyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (454mg). To the solution was added 1N sodium hydroxide solution (3.0ml), and the mixture was stirred at room temperature for 62 hours. To the mixture was added 1N hydrochloric acid to make the solution weak acidic, and the mixture was extracted with ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give 1-[(4-methylphenyl)sulfonyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid as white crystals. The obtained 1-[(4-methylphenyl)sulfonyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid was suspended in DMF (15.0ml). To the suspension was added thionyl chloride (0.15ml), and the mixture was stirred at room temperature for 1 hour. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in dichloromethane (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (296mg) was added dichloromethane (15.0ml), and then was added triethylamine (0.88ml). To the obtained mixture was added dropwise the previously prepared acid chloride solution, and the mixture was stirred at room temperature for 3 hours. To the mixture was added water, and the separated organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was recrystallized from ethanol to give 1-[(4-methylphenyl)sulfonyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (359mg, 60%) as white crystals.
 mp 258 - 262°C.
¹H-NMR (200 MHz, CDCl₃) δ 1.70 - 1.77 (4H, m), 2.21 (3H, s), 2.35 (3H, s), 2.53 - 2.74 (1H, m), 2.98 (2H, t, J = 5.5 Hz), 3.23 (4H, t, J = 4.9 Hz), 3.38 (2H, td, J = 10.4, 3.2 Hz), 3.58 (2H, s), 3.89 (4H, t, J = 4.8 Hz), 3.99 (2H, t, J = 5.4 Hz), 4.01 - 4.09 (2H, m), 6.99 (2H, d, J = 8.8 Hz), 6.97 - 7.06 (2H, m), 7.19 (2H, d, J = 7.6 Hz), 7.29 - 7.34 (2H, m), 7.45 (2H, d, J = 8.6 Hz), 7.53 (2H, d, J = 8.6 Hz), 7.50 - 7.65 (5H, m).
 IR (KBr) 1663, 1609, 1605, 1518, 1495, 1345, 1308, 1233, 1159, 1121, 1090, 928, 816, 733, 671 cm⁻¹.
 Anal. Calcd. for C₄₁H₄₆N₄O₅S (0.1H₂O additive): C, 69.49; H, 6.57; N, 7.91. Found C, 69.27; H, 6.63; N, 7.92.

Reference Example 9

[0118] In DMF (15.0ml) was suspended 1-acetyl-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (365mg). To the suspension was added thionyl chloride (0.17ml), and the mixture was stirred at room temperature for 1 hour. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in dichloromethane (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (327mg) was added dichloromethane (15.0ml), and then was added triethylamine (0.97ml). To the obtained mixture was added dropwise the previously prepared acid chloride suspension at 0°C, and the mixture was stirred at room temperature for 3 hours. To the mixture was added water, and the separated organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (50g, ethyl acetate : ethanol = 9 : 1) and washed with hexane/ethyl acetate to give 1-acetyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (116mg, 21%) as pale yellow crystals.
 mp 141 - 145°C.
¹H-NMR (200 MHz, CDCl₃) δ 1.65 - 1.87 (4H, m), 2.09 (3H, s), 2.23 (3H, s), 2.61 - 2.78 (1H, m), 2.81 - 3.05 (3H, m), 3.24 (4H, t, J = 4.7 Hz), 3.37 (2H, td, J = 11.4, 2.7 Hz), 3.60 (2H, s), 3.90 (4H, t, J = 4.8 Hz), 4.02 - 4.07 (2H, m), 4.75 - 4.91 (1H, m), 7.23 - 7.27 (1H, m), 7.34 (2H, d, J = 8.4 Hz), 7.52 - 7.69 (8H, m).
 IR (KBr) 1657, 1609, 1514, 1497, 1451, 1395, 1314, 1258, 1235 cm⁻¹.
 Anal. Calcd. for C₃₆H₄₂N₄O₄ (1.2H₂O additive): C, 70.15; H, 7.26; N, 9.09. Found C, 69.91; H, 7.05; N, 9.03.

Reference Example 10

[0119] In water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved (4-diethylamino)phenyl borate (234mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (391mg). To the solution was added potassium carbonate (268mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (37mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (45g, ethyl acetate:ethanol=20:1) and recrystallized from ethanol to give 7-(4-diethylaminophenyl)-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (145mg, 33%) as yellow crystals.

mp 178 - 180°C.

¹H NMR (200 MHz, CDCl₃) δ 1.19 (6H, t, J = 7.0 Hz), 1.64 - 1.76 (4H, m), 2.21 (3H, s), 2.54 - 2.72 (1H, m), 2.95 (2H, t, J = 4.5 Hz), 3.07 (3H, s), 3.31 - 3.44 (4H, m), 3.39 (4H, q, J = 7.1 Hz), 3.57 (2H, s), 4.01 - 4.07 (2H, m), 6.74 (2H, d, J = 9.0 Hz), 6.86 (1H, d, J = 8.6 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.41 - 7.59 (8H, m).

IR (KBr) 2948, 1644, 1597, 1514, 1497, 1406, 1312, 1283, 1246, 1188, 1071, 810, 733 cm⁻¹.

Anal. Calcd. for C₃₅H₄₄N₄O₂ (0.1H₂O additive): C, 75.80; H, 8.03; N, 10.10. Found C, 75.51; H, 7.95; N, 10.10.

Reference Example 11

[0120] In water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-propoxyphenyl borate (203mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide(455mg). To the solution was added potassium carbonate (312mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (43mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate : ethanol : triethylamine = 100 : 5 : 1) and recrystallized from ethanol/hexane to give 1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (349mg, 69%) as yellow crystals.

mp 149 - 151°C.

¹H NMR (200 MHz, CDCl₃) δ 1.05 (3H, t, J = 7.4 Hz), 1.63 - 1.76 (4H, m), 1.83 (2H, sextet, J = 7.2 Hz), 2.20 (3H, s), 2.53 - 2.73 (1H, m), 2.95 (2H, t, J = 4.5 Hz), 3.07 (3H, s), 3.31 - 3.43 (4H, m), 3.56 (2H, s), 3.96 (2H, t, J = 6.6 Hz), 4.01 - 4.07 (2H, m), 6.87 (1H, d, J = 8.4 Hz), 6.95 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 8.6 Hz), 7.39 (1H, s), 7.43 (1H, dd, J = 8.6, 2.2 Hz), 7.47 (2H, d, J = 8.6 Hz), 1H (d) was concealed under 7.49, 7.54 (2H, d, J = 8.6 Hz), 7.62 (1H, s).

IR (KBr) 2946, 1651, 1607, 1514, 1505, 1312, 1242, 1182, 814 cm⁻¹.

Anal. Calcd. for C₃₄H₄₁N₃O₃ (0.1H₂O additive): C, 75.41; H, 7.67; N, 7.76. Found C, 75.30; H, 7.75; N, 7.82.

Reference Example 12

[0121] In DMF (10.0ml) was suspended 1-formyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (433mg). To the suspension was added thionyl chloride (0.22ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the mixture was added THF (15.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (434mg) was added THF (10.0ml) and then added triethylamine (1.29ml). The previously prepared acid chloride suspension was added dropwise at 0°C. The mixture was stirred at room temperature for 4 hours. To the mixture was added water, and the mixture was washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was recrystallized from ethanol to give 1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (554mg, 81%) as white crystals.

mp 207 - 209°C.

¹H NMR (200 MHz, CDCl₃) δ 1.06 (3H, t, J = 7.4 Hz), 1.63 - 1.77 (4H, m), 1.85 (2H, sextet, J = 7.0 Hz), 2.21 (3H, s), 2.57 - 2.72 (1H, m), 3.04 (2H, t, J = 4.8 Hz), 3.37 (2H, td, J = 11.4, 3.1 Hz), 3.57 (2H, s), 3.90 - 4.08 (6H, m), 7.00 (2H, d, J = 9.0 Hz), 7.20 (1H, d, J = 8.2 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.47 - 7.54 (6H, m), 7.57 (1H, dd, J = 8.0, 2.2 Hz), 7.68 (1H, d, J = 2.0 Hz), 8.56 (1H, s).

IR (KBr) 1669, 1609, 1522, 1497, 1360, 1314, 1252 cm⁻¹.

Anal. Calcd. for C₃₄H₃₉N₃O₄: C, 73.75; H, 7.10; N, 7.59. Found C, 73.48; H, 7.11; N, 7.50.

Reference Example 13

[0122] In THF (10.0ml) and catalytic amount of DMF was suspended 1-methylsulfonyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (236mg). To the suspension was added oxalyl chloride (0.13ml), and the mixture was stirred at room temperature for 1 hour. Under reduced pressure, the solvent was evaporated. To the residue was added THF (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (207mg) was added THF (10.0ml), and then was added triethylamine (0.61ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 3.5 hours. To the mixture was added ethyl acetate, and the mixture was washed with water, 1N sodium hydroxide solution, water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (10g, ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 1-methylsulfonyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (205mg, 58%) as white crystals.

mp 199 - 202°C.

¹H NMR (200 MHz, CDCl₃) δ 1.06 (3H, t, J = 7.4 Hz), 1.63 - 1.79 (4H, m), 1.85 (2H, sextet, J = 7.0 Hz), 2.21 (3H, s), 2.54 - 2.74 (1H, m), 2.98 (3H, s), 3.14 (2H, t, J = 5.2 Hz), 3.38 (2H, td, J = 11.3, 3.2 Hz), 3.58 (2H, s), 3.89 - 4.07 (6H, m), 6.96 - 7.03 (2H, m), 7.33 (2H, d, J = 8.4 Hz), 7.47 - 7.67 (9H, m).

IR (KBr) 1653, 1609, 1518, 1493, 1341, 1314, 1248, 1154 cm⁻¹.

Anal. Calcd. for C₃₄H₄₂N₃O₅S: C, 67.64; H, 6.84; N, 6.96. Found C, 67.37; H, 6.77; N, 6.89.

Reference Example 14

[0123] In THF (10.0ml) and catalytic amount of DMF was suspended 7-(4-ethoxy-3-fluorophenyl)-1-methylsulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (182mg). To the suspension was added oxalyl chloride (0.12ml), and the mixture was stirred at room temperature for 1 hour. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (158mg) was added THF (10.0ml), and then was added triethylamine (0.47ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 3 hours. To the mixture was added ethyl acetate, and the mixture was washed with water, 1N sodium hydroxide solution, water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (15g, ethyl acetate → ethyl acetate : ethanol : triethylamine = 100 : 10 : 1), and recrystallized from ethanol to give 7-(4-ethoxy-3-fluorophenyl)-1-methylsulfonyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (140mg, 51%) as white crystals.

mp 199 - 202°C.

¹H NMR (200 MHz, CDCl₃) δ 1.49 (3H, t, J = 7.0 Hz), 1.64 - 1.77 (4H, m), 2.21 (3H, s), 2.57 - 2.70 (1H, m), 2.89 (3H, s), 3.14 (2H, t, J = 5.4 Hz), 3.38 (2H, td, J = 11.3, 2.9 Hz), 3.57 (2H, s), 3.91 (2H, t, J = 5.7 Hz), 4.02 - 4.07 (2H, m), 4.17 (2H, q, J = 6.9 Hz), 7.04 (1H, t, J = 8.8 Hz), 7.28 - 7.35 (3H, m), 7.48 - 7.61 (7H, m), 7.65 (1H, d, J = 8.4 Hz).

IR (KBr) 1661, 1522, 1497, 1343, 1310, 1269, 1238, 1154, 1138 cm⁻¹.

Anal. Calcd. for C₃₃H₃₈FN₃O₅S (0.3H₂O additive) C, 64.64; H, 6.35; N, 6.85. Found C, 64.46; H, 6.41; N, 6.80.

Reference Example 15

[0124] In DMF (5.5ml) was dissolved 7-(4-ethoxy-3-fluorophenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (398mg). To the solution was added thionyl chloride (0.20ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (394mg) was added THF (10.0ml), and then was added triethylamine (1.17 ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 4 hours. To the mixture was added ethyl acetate, and the mixture was washed with water, 1N sodium hydroxide solution, water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was recrystallized from ethanol to give 7-(4-ethoxy-3-fluorophenyl)-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (453mg; 73%) as white crystals.

mp 193 - 196°C.

¹H NMR (200 MHz, CDCl₃) δ 1.49 (3H, t, J = 7.0 Hz), 1.64 - 1.75 (4H, m), 2.21 (3H, s), 2.58 - 2.74 (1H, m), 3.04 (2H, t, J = 5.0 Hz), 3.37 (2H, td, J = 11.3, 3.1 Hz), 3.58 (2H, s), 3.92 (2H, t, J = 5.3 Hz), 4.02 - 4.07 (2H, m), 4.17 (2H, q, J

= 7.1 Hz), 7.05 (1H, t, J = 8.6 Hz), 7.20 (1H, d, J = 8.4 Hz), 7.29 - 7.37 (5H, m), 7.45 (1H, s), 7.54 (2H, d, J = 8.4 Hz), 7.56 (1H, s), 7.66 (1H, d, J = 2.0 Hz), 8.55 (1H, s).

IR (KBr) 1667, 1514, 1501, 1360, 1314, 1269, 1238 cm^{-1} .

Anal. Calcd. for $\text{C}_{33}\text{H}_{38}\text{FN}_3\text{O}_4$ (0.1 H_2O additive): C, 70.85; H, 6.52; N, 7.51. Found C, 70.55; H, 6.54; N, 7.45.

5

Reference Example 16

[0125] A solution of methyl 5-bromo-N-tosylanthranilate (200g) in DMF (450ml) was added dropwise, under ice-cooling, to a suspension of 60% sodium hydride (25g) in DMF (50ml). Under nitrogen atmosphere, the mixture was stirred at room temperature for 2 hours, and to the mixture were added sodium iodide (78g) and ethyl 4-bromobutyrate (82ml). The mixture was stirred under nitrogen atmosphere at 85°C for 24 hours, and to the mixture was added potassium t-butoxide (70g) under ice-cooling. The mixture was stirred at 85°C for 1.5 hours, and the solvent was evaporated. To the residue was added ice-water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give ethyl (methyl) 7-bromo-5-hydroxy-1-tosyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (mixture) (153g) as white crystals.

^1H NMR (δ ppm, CDCl_3) 1.31 (1.5H, t, J = 7.1 Hz), 2.29 (2H, t, J = 6.4 Hz), 2.40 (3H, s), 3.72 (1.5H, s), 4.08 (2H, t, J = 6.4 Hz), 4.17 (1H, q, J = 7.1 Hz), 7.17 (2H, d, J = 8.2 Hz), 7.38 (2H, d, J = 8.0 Hz), 7.41 - 7.46 (1H, m), 7.60 - 7.66 (2H, m), 11.83 (0.5H, s), 11.91 (0.5H, s).

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Reference Example 17

[0126] To ethyl (methyl) 7-bromo-5-hydroxy-1-tosyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (mixture) (32.4g) were added acetic acid (200ml) and concentrated sulfuric acid (120ml), and the mixture was stirred at 80°C for 2.5 hours. The mixture was poured into ice-water, and the mixture was neutralized with sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (hexane/ethyl acetate) to give 7-bromo-1,2,3,4-tetrahydro-1-benzazepin-5-one (8.55g) as pale yellow crystals. mp 99 - 101°C.

^1H NMR (δ ppm, CDCl_3) 2.18 (2H, quint, J = 7.1 Hz), 2.82 (2H, t, J = 7.2 Hz), 3.25 (2H, t, J = 6.6 Hz), 4.65 (1H, br), 6.65 (1H, d, J = 8.6 Hz), 7.20 (1H, dd, J = 2.2, 8.6 Hz), 7.82 (1H, d, J = 2.2 Hz).

IR (KBr) v: 3364, 2955, 1661 cm^{-1} .

30

Reference Example 18

[0127] In THF (200ml) were dissolved 7-bromo-1,2,3,4-tetrahydro-1-benzazepin-5-one (7g) and dimethylaminopyridine (22g). To the solution was added di-t-butyl dicarbonate (60g), and the mixture was refluxed for 1.5 hours. The solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with 1M citric acid solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give a mixture of 7-bromo-1-(t-butoxycarbonyl)-1,2,3,4-tetrahydro-1-benzazepin-5-one and 7-bromo-1-(t-butoxycarbonyl)-5-(t-butoxycarbonyloxy)-2,3-dihydro-1H-1-benzazepine (24.6g) as yellow oil.

^1H NMR (δ ppm, CDCl_3) 1.43 (4.5H, s), 1.49 (9H, s), 2.15 (1H, quint, J = 6.8 Hz), 2.76 (2H, t, J = 6.8 Hz), 3.73 (2H, t, J = 6.8 Hz), 5.97 (0.5H, t, J = 4.6 Hz), 7.17 (0.5H, br), 7.35 (1H, br), 7.54 - 7.59 (1H, m), 7.98 (0.5H, d, J = 2.6 Hz).

45

Reference Example 19

[0128] In dimethyl carbonate (400ml) was dissolved a mixture (3.3g) of 7-bromo-1-(t-butoxycarbonyl)-1,2,3,4-tetrahydro-1-benzazepin-5-one and 7-bromo-1-(t-butoxycarbonyl)-5-(t-butoxycarbonyloxy)-2,3-dihydro-1H-1-benzazepine. To the solution was added sodium methoxide (23.0g), and the mixture was refluxed under nitrogen atmosphere for 2.5 hours and poured into ice-water. To the mixture was added 1M citric acid solution, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-bromo-1-(t-butoxycarbonyl)-1,2,3,4-tetrahydro-1-benzazepin-5-one-4-carboxylate (23.8g) as yellow oil.

^1H NMR (δ ppm, CDCl_3) 1.36 (4.5H, s), 1.52 (4.5H, s), 2.43 - 2.55 (2H, m), 3.39 - 3.54 (0.5H, m), 3.72 (1.5H, s), 3.84 (1.5H, s), 3.89 - 4.04 (2H, m), 7.12 (0.5H, br), 7.42 (0.5H, br), 7.51 (0.5H, dd, J = 2.2, 8.4 Hz), 7.58 (0.5H, dd, J = 2.4, 8.6 Hz), 7.82 (0.5H, d, J = 2.2 Hz), 8.00 (0.5H, d, J = 2.2 Hz).

55

Reference Example 20

[0129] In THF (150ml) was dissolved methyl 7-bromo-1-(t-butoxycarbonyl)-1,2,3,4-tetrahydro-1-benzazepin-5-one-4-carboxylate (7.2g). To the solution was added sodium borohydride (0.7g) at -40°C, and then was added dropwise methanol (15ml). The mixture was stirred at -15°C for 1 hour. To the mixture was added 1M citric acid, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was dissolved in THF (150ml), and to the solution was added triethylamine (7.5ml). To the mixture was added dropwise, under ice-cooling, methanesulfonyl chloride (2.1ml). Under nitrogen atmosphere, the mixture was stirred at room temperature for 1.5 hours, and to the mixture was added dropwise DBU (13.5ml) at room temperature. The mixture was stirred at 90°C for 10 minutes, and the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (5.18g) as colorless crystals.

mp 144 - 145°C.

¹H NMR (δ ppm, CDCl₃) 1.47 (9H, s), 2.89 (2H, t, J = 4.8 Hz), 3.61 (2H, br), 3.83 (3H, s), 7.27 (1H, br), 7.39 (1H, dd, J = 1.8, 8.4 Hz), 7.54 - 7.55 (2H, m).

IR (KBr) ν: 2978, 1709 cm⁻¹.

Anal. Calcd. for C₁₇H₂₀BrNO₄: C, 53.42; H, 5.27; N, 3.66. Found C, 53.58; H, 5.12; N, 3.52.

Reference Example 21

[0130] In ethyl acetate (50ml) was dissolved methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.5g). To the solution was added 6N hydrochloric acid (2ml), and the mixture was heated to stir at 80°C for 2 hours, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g) as yellow crystals.

mp 143 - 145°C.

¹H NMR (δ ppm, CDCl₃) 2.85 (2H, t, J = 4.8 Hz), 3.35 (2H, t, J = 4.8 Hz), 3.80 (3H, s), 4.62 (1H, br), 6.49 (1H, d, J = 8.4 Hz), 7.15 (1H, dd, J = 2.4, 8.4 Hz), 7.37 (1H, d, J = 2.4 Hz), 7.53 (1H, s).

IR (KBr) ν: 3384, 2949, 1694 cm⁻¹.

Anal. Calcd. for C₁₂H₁₂BrNO₂: C, 51.09; H, 4.29; N, 4.96. Found C, 51.17; H, 4.32; N, 4.97.

Reference Example 22

[0131] To anhydrous acetic acid (0.84ml) was added dropwise formic acid (0.4ml), under ice-cooling, and the mixture was stirred, under nitrogen atmosphere, at 50°C for 2 hours. To the mixture was added THF (5ml), and to the mixture was added dropwise, under ice-cooling, a solution of methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g in THF (15ml)). The mixture was stirred at room temperature overnight. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.07g) as colorless crystals.

mp 175 - 176°C.

¹H NMR (δ ppm, CDCl₃) 2.93 (2H, t, J = 5.3 Hz), 3.80 (2H, t, J = 5.3 Hz), 3.83 (3H, s), 7.01 (1H, d, J = 8.5 Hz), 7.50 (1H, dd, J = 2.2, 8.5 Hz), 7.58 (1H, s), 7.65 (1H, d, J = 2.2 Hz), 8.46 (1H, s).

IR (KBr) ν: 2951, 1713, 1680 cm⁻¹.

Anal. Calcd. for C₁₃H₁₂BrNO₃: C, 50.34; H, 3.90; N, 4.52. Found C, 50.43; H, 3.75; N, 4.45.

Reference Example 23

[0132] To a mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (3.51g), 4-morpholinophenyl borate (3.51g) and potassium carbonate (3.75g) was added a mixture of water (20ml), ethanol (20ml) and toluene (100ml), and the mixture was stirred under argon atmosphere at room temperature for 40 minutes. To the mixture was added tetrakis(triphenylphosphine)-palladium (0.52g), and the mixture was refluxed under argon atmosphere for 12 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-formyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g) as colorless crystals.

zazepine-4-carboxylate (3.64g) as pale yellow crystals.

mp 178 - 181°C.

¹H NMR (δ ppm, CDCl₃) 2.95 (2H, t, J = 5.1 Hz), 3.23 (4H, t, J = 4.9 Hz), 3.82 - 3.92 (6H, m), 3.84 (3H, s), 6.97 - 7.04 (2H, m), 7.17 (1H, d, J = 8.2 Hz), 7.45 - 7.60 (3H, m), 7.69 (1H, d, J = 2.2 Hz), 7.76 (1H, s), 8.53 (1H, s).

5 IR (KBr) v: 2951, 2830, 1709, 1674 cm⁻¹.

Reference Example 24

10 **[0133]** In methanol (250ml) and THF (250ml) was dissolved methyl 1-formyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (3.54g). To the solution was added 1N sodium hydroxide solution (90ml), and the mixture was stirred at room temperature overnight and concentrated. To the mixture was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 1-formyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (3.30g) as colorless crystals.

15 mp 247 - 257°C (dec.).

¹H NMR (δ ppm, DMSO-d₆) 2.75 (2H, t-like), 3.14 - 3.19 (4H, m), 3.70 - 3.78 (6H, m), 7.03 (2H, d, J = 8.8 Hz), 7.36 (1H, d, J = 8.4 Hz), 7.62 - 7.71 (4H, m), 7.87 (1H, s), 8.51 (1H, s).

IR (KBr) v: 1671 cm⁻¹.

Anal. Calcd. for C₂₂H₂₂N₂O₄·0.7H₂O: C, 67.57; H, 6.03; N, 7.16. Found C, 67.48; H, 5.74; N, 6.98.

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Reference Example 25

25 **[0134]** A mixture of methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (2.0g), 4-morpholinophenyl borate (1.2g), and 1M potassium carbonate solution (15ml), ethanol (15ml) and toluene (100ml) was stirred under argon atmosphere at room temperature for 20 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.24g), and the mixture was refluxed under argon atmosphere for 12 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-(t-butoxycarbonyl)-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (3.64g) as pale yellow crystals.

30 mp 183 - 185°C.

¹H-NMR (δ ppm, CDCl₃) 1.49 (9H, s), 2.90 (2H, t, J = 5.0 Hz), 3.19 - 3.24 (4H, m), 3.69 (2H, br), 3.83 (3H, s), 3.87 - 3.91 (4H, m), 6.98 (2H, d, J = 9.0 Hz), 7.48 (2H, br), 7.52 (2H, d, J = 9.0 Hz), 7.58 (1H, s), 7.73 (1H, s).

IR (KBr) v: 2973, 1705 cm⁻¹.

35 Anal. Calcd. for C₂₇H₃₂N₂O₅: C, 69.81; H, 6.94; N, 6.03. Found C, 69.57; H, 6.76; N, 5.76.

Reference Example 26

40 **[0135]** In ethyl acetate (100ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (2.0g). To the solution was added 6N hydrochloric acid (40ml), and the mixture was stirred at 80°C for 30 minutes, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.46g) as yellow crystals.

mp 175 - 182°C (dec.).

45 ¹H-NMR (δ ppm, CDCl₃) 2.89 (2H, t, J = 4.5 Hz), 3.17 - 3.22 (4H, m), 3.41 (2H, t, J = 4.5 Hz), 3.81 (3H, s), 3.87 - 3.91 (4H, m), 6.67 (1H, d, J = 8.3 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.33 (1H, dd, J = 2.0, 8.3 Hz), 7.45 - 7.50 (3H, m), 7.73 (1H, s).

IR (KBr) v: 3378, 2953, 1694 cm⁻¹.

Anal. Calcd. for C₂₂H₂₄N₂O₃·0.2H₂O: C, 71.80; H, 6.68; N, 7.61. Found C, 71.51; H, 6.72; N, 7.47.

50

Reference Example 27

55 **[0136]** To anhydrous acetic acid (0.2ml) was added dropwise formic acid (0.1ml), under ice-cooling, and the mixture was heated to stir under nitrogen atmosphere at 50°C for 2 hours. To the mixture was added THF (5ml), and then to the mixture was added dropwise, under ice-cooling, a solution of methyl 7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) in THF (15ml). The mixture was stirred at room temperature for 1.5 hours. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 1-formyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-ben-

zazepine-4-carboxylate (0.3g) as pale yellow crystals.

Reference Example 28

- 5 **[0137]** A mixture of methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g), 4-ethoxyphenyl borate (0.5g), 1M potassium carbonate solution (8ml), ethanol (8ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.12g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-(t-butoxycarbonyl)-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g) as colorless crystals.
- 10 ¹H-NMR (δ ppm, CDCl₃) 1.38 - 1.49 (12H, m), 2.91 (2H, t, J = 5.3 Hz), 3.68 (2H, br), 3.83 (3H, s), 4.09 (2H, q, J = 7.0 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.47 - 7.55 (4H, m), 7.58 (1H, s), 7.74 (1H, s).
- 15 IR (KBr) v: 2980, 1705 cm⁻¹.

Reference Example 29

- 20 **[0138]** In ethyl acetate (50ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-(4-ethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g). To the solution was added 6N hydrochloric acid (10ml) and the mixture was stirred at 80°C for 40 minutes, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-(4-ethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.78g) as yellow crystals.
- mp 157 - 158°C.
- 25 ¹H-NMR (δ ppm, CDCl₃) 1.43 (3H, t, J = 7.0 Hz), 2.88 (2H, t, J = 4.6 Hz), 3.40 (2H, t, J = 4.6 Hz), 3.81 (3H, s), 4.07 (2H, q, J = 7.0 Hz), 6.66 (1H, d, J = 8.3 Hz), 6.94 (2H, d, J = 9.2 Hz), 7.31 (1H, dd, J = 2.2, 8.3 Hz), 7.41 - 7.47 (3H, m), 7.73 (1H, s).
- IR (KBr) v: 3380, 2980, 2948, 1699 cm⁻¹.

Reference Example 30

- 30 **[0139]** To anhydrous acetic acid (0.18ml) was added dropwise formic acid (0.09ml) under ice-cooling, and the mixture was stirred under nitrogen atmosphere at 50°C for 2 hours. To the mixture was added THF (2ml) and then was added dropwise, under ice-cooling a solution of methyl 7-(4-ethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) in THF (15ml), and the mixture was stirred at room temperature for 4 hours. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-(4-ethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.24g) as yellow crystals.
- 40 mp 133 - 135°C.
- ¹H-NMR (δ ppm, CDCl₃) 1.45 (3H, t, J = 6.9 Hz), 2.95 (2H, t, J = 4.9 Hz), 3.82 - 3.88 (5H, m), 4.09 (2H, q, J = 6.9 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.17 (1H, d, J = 8.0 Hz), 7.49 - 7.58 (3H, m), 7.68 (1H, d, J = 2.2 Hz), 7.75 (1H, s), 8.53 (1H, s).
- IR (KBr) v: 2980, 2948, 1709, 1678 cm⁻¹.

Reference Example 31

- 45 **[0140]** In methanol (25ml) and THF (30ml) was dissolved methyl 7-(4-ethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.24g). To the solution was added 1N sodium hydroxide solution (5ml) and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-(4-ethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.23g) as pale yellow crystals.
- 50 mp 224 - 226°C.
- ¹H-NMR (δ ppm, CDCl₃) 1.46 (3H, t, J = 6.9 Hz), 2.97 (2H, t, J = 5.1 Hz), 3.88 (2H, t, J = 5.1 Hz), 4.10 (2H, q, J = 6.9 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.20 (1H, d, J = 8.1 Hz), 7.53 (2H, d, J = 8.8 Hz), 7.59 (1H, dd, J = 2.0, 8.1 Hz), 7.70 (1H, d, J = 2.0 Hz), 7.86 (1H, s), 8.56 (1H, s).
- 55 IR (KBr) v: 2982, 1669, 1682 cm⁻¹.
- Anal. Calcd. for C₂₀H₁₉NO₄·0.4H₂O: C, 69.71; H, 5.79; N, 4.06. Found C, 69.80; H, 6.00; N, 3.80.

Reference Example 32

[0141] A mixture of methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g), 4-(2-ethoxyethoxy)phenyl borate (0.6g), 1M potassium carbonate solution (8ml), ethanol (8ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 20 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.12g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-(t-butoxycarbonyl)-7-[4-(2-ethoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g) as colorless oil.

¹H-NMR (δ ppm, CDCl₃) 1.26 (3H, t, J = 7.1 Hz), 1.49 (9H, s), 2.91 (2H, t, J = 4.8 Hz), 3.63 (2H, q, J = 7.1 Hz), 3.68 (2H, br), 3.83 (2H, t, J = 4.9 Hz), 3.83 (3H, s), 4.17 (2H, t, J = 4.9 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.47 - 7.53 (4H, m), 7.58 (1H, s), 7.73 (1H, s).

IR (neat) v: 2976, 1705 cm⁻¹.

Reference Example 33

[0142] In ethyl acetate (50ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-[4-(2-ethoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g). To the solution was added 6N hydrochloric acid (20ml), and the mixture was stirred at 80°C for 45 minutes, neutralized with 1N sodium hydroxide solution and was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-[4-(2-ethoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.7g) as yellow crystals.

mp 102 - 108°C.

¹H-NMR (δ ppm, CDCl₃) 1.26 (3H, t, J = 7.0 Hz), 2.88 (2H, t, J = 4.7 Hz), 3.40 (2H, t, J = 4.7 Hz), 3.62 (2H, q, J = 7.0 Hz), 3.81 (3H, s), 3.82 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.67 (1H, d, J = 8.5 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.31 (1H, dd, J = 2.2, 8.5 Hz), 7.42 - 7.47 (3H, m), 7.73 (1H, s).

IR (KBr) v: 3370, 2976, 2946, 2870, 1698 cm⁻¹.

Anal. Calcd. for C₂₂H₂₅NO₄: C, 71.91; H, 6.86; N, 3.81. Found C, 71.88; H, 6.79; N, 3.78.

Reference Example 34

[0143] To anhydrous acetic acid (0.25ml) was added formic acid (0.13ml) under ice-cooling, and the mixture was stirred under nitrogen atmosphere at 50°C for 2 hours. To the mixture was added THF (2ml) and then was added dropwise, under ice-cooling, a solution of methyl 7-[4-(2-ethoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) in THF (10ml), and the mixture was stirred at room temperature overnight. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g) as colorless crystals.

mp 138 - 142°C.

¹H-NMR (δ ppm, CDCl₃) 1.27 (3H, t, J = 6.9 Hz), 2.95 (2H, t, J = 5.1 Hz), 3.63 (2H, q, J = 6.9 Hz), 3.81 - 3.88 (7H, m), 4.19 (2H, t, J = 5.0 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.17 (1H, d, J = 8.2 Hz), 7.48 - 7.59 (3H, m), 7.68 (1H, d, J = 2.2 Hz), 7.75 (1H, s).

IR (KBr) v: 2872, 1709, 1678 cm⁻¹.

Anal. Calcd. for C₂₃H₂₅NO₅: C, 69.86; H, 6.37; N, 3.54. Found C, 69.88; H, 6.43; N, 3.49.

Reference Example 35

[0144] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g). To the solution was added 1N sodium hydroxide solution (5ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.19g) as colorless crystals.

mp 190 - 192°C.

¹H-NMR (δ ppm, CDCl₃) 1.27 (3H, t, J = 7.0 Hz), 2.97 (2H, t, J = 4.4 Hz), 3.64 (2H, q, J = 7.0 Hz), 3.81 - 3.90 (4H, m), 4.19 (2H, t, J = 5.0 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.2 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.59 (1H, dd, J =

2.2, 8.2 Hz), 7.69 (1H, d, J = 2.2 Hz), 7.85 (1H, s), 8.55 (1H, s).
 IR (KBr) ν : 2936, 2872, 1682, 1671 cm^{-1} .
 Anal. Calcd. for $\text{C}_{22}\text{H}_{23}\text{NO}_5$: C, 69.28; H, 6.08; N, 3.67. Found C, 69.00; H, 6.31; N, 3.56.

5 Reference Example 36

[0145] A mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (20g), 4-(2-ethoxyethoxy)phenyl borate (14.9g), 1M potassium carbonate solution (130ml), ethanol (130ml) and toluene (1000ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (3g), and the mixture was refluxed under argon atmosphere for 15 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (25.2g) as colorless crystals.

15 Reference Example 37

[0146] A mixture of methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g), 4-(3-ethoxypropoxy)phenyl borate (0.62g), 1M potassium carbonate solution (8ml), ethanol (8ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.12g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-(t-butoxycarbonyl)-7-[4-(3-ethoxypropoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.2g) as colorless crystals.
 mp 125 - 128°C.
 $^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.21 (3H, t, J = 7.0 Hz), 1.49 (9H, s), 2.02 - 2.14 (2H, m), 2.91 (2H, t, J = 4.2 Hz), 3.51 (2H, q, J = 7.0 Hz), 3.62 (2H, t, J = 6.3 Hz), 3.65 (2H, br), 3.83 (3H, s), 4.12 (2H, t, J = 6.2 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.40 - 7.55 (4H, m), 7.57 (1H, s), 7.73 (1H, s).
 IR (KBr) ν : 2976, 2948, 2872, 1705 cm^{-1} .

Reference Example 38

[0147] In ethyl acetate (50ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-[4-(3-ethoxypropoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.2g). To the solution was added 6N hydrochloric acid (10ml), and the mixture was stirred at 80°C for 30 minutes, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-[4-(3-ethoxypropoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.8g) as yellow crystals.
 mp 99 - 102°C.
 $^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.21 (3H, t, J = 7.0 Hz), 2.01 - 2.13 (2H, m), 2.88 (2H, t, J = 4.7 Hz), 3.41 (2H, t, J = 4.7 Hz), 3.51 (2H, q, J = 7.0 Hz), 3.62 (2H, t, J = 6.2 Hz), 3.81 (3H, s), 4.10 (2H, t, J = 6.2 Hz), 4.78 (1H, br), 6.67 (1H, d, J = 8.5 Hz), 6.95 (2H, d, J = 8.8 Hz), 7.32 (1H, dd, J = 2.2, 8.5 Hz), 7.43 - 7.47 (3H, m), 7.73 (1H, s).
 IR (KBr) ν : 3374, 2949, 2868, 1699 cm^{-1} .
 Anal. Calcd. for $\text{C}_{23}\text{H}_{27}\text{NO}_4$: C, 72.42; H, 7.13; N, 3.67. Found C, 72.24; H, 7.04; N, 3.67.

Reference Example 39

[0148] To anhydrous acetic acid (0.22ml) was added dropwise formic acid (0.11ml) under ice-cooling, and the mixture was stirred under nitrogen atmosphere at 50°C for 2 hours. To the mixture was added THF (2ml) and then was added dropwise, under ice-cooling, a solution of methyl 7-[4-(3-ethoxypropoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.35g) in THF (15ml), and the mixture was stirred at room temperature overnight. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-[4-(3-ethoxypropoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.36g) as colorless crystals.
 mp 112 - 113°C.
 $^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.22 (3H, t, J = 7.0 Hz), 2.03 - 2.15 (2H, m), 2.95 (2H, t, J = 4.8 Hz), 3.52 (2H, q, J = 7.0 Hz),

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3.63 (2H, t, J = 6.3 Hz), 3.84 (3H, s), 3.84 (2H, t, J = 4.8 Hz), 4.13 (2H, t, J = 6.3 Hz), 7.01 (2H, d, J = 8.8 Hz), 7.17 (1H, d, J = 8.2 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.56 (1H, dd, J = 2.2, 8.8 Hz), 7.68 (1H, d, J = 2.2 Hz), 7.75 (1H, s), 8.53 (1H, s).

IR (KBr) ν : 2951, 2872, 1709, 1678 cm^{-1} .

5 Anal. Calcd. for $\text{C}_{24}\text{H}_{27}\text{NO}_5 \cdot 0.2\text{H}_2\text{O}$: C, 69.78; H, 6.69; N, 3.39. Found C, 69.98; H, 6.79; N, 3.28.

Reference Example 40

10 [0149] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(3-ethoxypropoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g). To the solution was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at 50°C for 1.5 hours and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(3-ethoxypropoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.3g) as colorless crystals.

15 mp 179 - 181°C.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.22 (3H, t, J = 7.1 Hz), 2.03 - 2.15 (2H, m), 2.97 (2H, t, J = 5.5 Hz), 3.52 (2H, q, J = 7.1 Hz), 3.63 (2H, t, J = 6.3 Hz), 3.88 (2H, t, J = 5.5 Hz), 4.13 (2H, t, J = 6.0 Hz), 7.01 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.1 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.58 (1H, dd, J = 2.0, 8.1 Hz), 7.69 (1H, d, J = 2.0 Hz), 7.85 (1H, s), 8.55 (1H, s).

IR (KBr) ν : 3036, 2870, 1682 cm^{-1} .

20 Anal. Calcd. for $\text{C}_{23}\text{H}_{25}\text{NO}_5$: C, 69.86; H, 6.37; N, 3.54. Found C, 69.64; H, 6.32; N, 3.55.

Reference Example 41

25 [0150] A mixture of methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g), 3,4-diethoxyphenyl borate (0.63g), 1M potassium carbonate solution (8ml), ethanol (8ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.12g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-benzazepine-4-carboxylate (1.3g) as colorless crystals.

30 mp 168 - 173°C.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.45 - 1.53 (15H, m), 2.90 (2H, t, J = 5.0 Hz), 3.68 (2H, br), 3.83 (3H, s), 4.09 - 4.23 (4H, m), 6.95 (1H, d, J = 9.2 Hz), 7.09 - 7.14 (2H, m), 7.40 - 7.52 (2H, m), 7.57 (1H, s), 7.74 (1H, s).

IR (KBr) ν : 2980, 1705 cm^{-1} .

35 Anal. Calcd. for $\text{C}_{27}\text{H}_{33}\text{NO}_6$: C, 69.36; H, 7.11; N, 3.00. Found C, 69.17; H, 7.11; N, 2.93.

Reference Example 42

40 [0151] In ethyl acetate (50ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-(3,4-diethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.3g). To the solution was added 6N hydrochloric acid (10ml), and the mixture was stirred at 80°C for 1 hour, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give methyl 7-(3,4-diethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.7g) as yellow crystals.

45 mp 159 - 164°C.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 1.43 - 1.52 (6H, m), 2.89 (2H, t, J = 4.8 Hz), 3.41 (2H, t, J = 4.8 Hz), 3.81 (3H, s), 4.08 - 4.22 (4H, m), 6.67 (1H, d, J = 8.4 Hz), 6.92 (1H, d, J = 9.2 Hz), 7.03 - 7.07 (2H, m), 7.31 (1H, dd, J = 2.2, 8.2 Hz), 7.45 (1H, d, J = 2.2 Hz), 7.73 (1H, s).

IR (KBr) ν : 3391, 2980, 1688 cm^{-1} .

50 Anal. Calcd. for $\text{C}_{22}\text{H}_{25}\text{NO}_4 \cdot 0.2\text{H}_2\text{O}$: C, 71.21; H, 6.90; N, 3.77. Found C, 71.23; H, 6.88; N, 3.67.

Reference Example 43

55 [0152] To anhydrous acetic acid (0.22ml) was added dropwise formic acid (0.11ml) under ice-cooling, and the mixture was stirred under nitrogen atmosphere at 50°C for 2 hours. To the mixture was added THF (2ml) and then was added dropwise, under ice-cooling, a solution of methyl 7-(3,4-diethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.35g) in THF (20ml), and the mixture was stirred at room temperature overnight. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate, and

the solvent was evaporated to give methyl 7-(3,4-diethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-carboxylate (0.35g) as colorless crystals.

mp 152 - 153°C.

¹H-NMR (δ ppm, CDCl₃) 1.45 - 1.54 (6H, m), 2.95 (2H, t, J = 5.3 Hz), 3.82 - 3.88 (5H, m), 4.10 - 4.24 (4H, m), 6.97 (1H, d, J = 8.8 Hz), 7.11 - 7.19 (3H, m), 7.56 (1H, dd, J = 2.2, 8.4 Hz), 7.67 (1H, d, J = 2.2 Hz), 7.76 (1H, s), 8.53 (1H, s). IR (KBr) v: 2980, 1709, 1678 cm⁻¹.

Anal. Calcd. for C₂₃H₂₅NO₅·0.2H₂O: C, 69.23; H, 6.42; N, 3.51. Found C, 69.39; H, 6.39; N, 3.48.

Reference Example 44

[0153] In methanol (25ml) and THF (25ml) was dissolved methyl 7-(3,4-diethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.33g). To the solution was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-(3,4-diethoxyphenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.32g) as colorless crystals.

mp 228 - 233°C (dec.).

¹H-NMR (δ ppm, CDCl₃) 1.49 (3H, t, J = 7.0 Hz), 1.50 (3H, t, J = 7.0 Hz), 2.97 (2H, t, J = 5.5 Hz), 3.88 (2H, t, J = 5.5 Hz), 4.11 - 4.24 (4H, m), 6.97 (1H, d, J = 8.7 Hz), 7.11 - 7.21 (3H, m), 7.59 (1H, dd, J = 2.0, 8.7 Hz), 7.69 (1H, d, J = 2.0 Hz), 7.86 (1H, s), 8.55 (1H, s).

IR (KBr) v: 2980, 1682, 1669 cm⁻¹.

Anal. Calcd. for C₂₂H₂₃NO₅: C, 69.28; H, 6.08; N, 3.67. Found C, 69.31; H, 6.23; N, 3.60.

Reference Example 45

[0154] A mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g), 4-(2-butoxyethoxy)phenyl borate (0.23g), 1M potassium carbonate solution (2.5ml), ethanol (2.5ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.04g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.23g) as colorless oil.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.34 - 1.45 (2H, m), 1.55 - 1.69 (2H, m), 2.94 (2H, t, J = 5.0 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.79 - 3.87 (7H, m), 4.18 (2H, t, J = 5.0 Hz), 7.02 (2H, d, J = 9.2 Hz), 7.17 (1H, d, J = 8.4 Hz), 7.48 - 7.58 (3H, m), 7.68 (1H, d, J = 2.2 Hz), 7.75 (1H, s), 8.53 (1H, s).

IR (neat) v: 2938, 2870, 1713, 1682 cm⁻¹.

Reference Example 46

[0155] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.23g). To the solution was added 1N sodium hydroxide solution (5ml), and the mixture was stirred at 55°C for 1.5 hours and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.24g) as colorless amorphous.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.27 - 1.45 (2H, m), 1.55 - 1.66 (2H, m), 2.97 (2H, t, J = 4.9 Hz), 3.57 (2H, t, J = 6.8 Hz), 3.80 - 3.90 (4H, m), 4.18 (2H, t, J = 4.9 Hz), 7.06 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.2 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.58 (1H, dd, J = 2.0, 8.2 Hz), 7.69 (1H, d, J = 2.0 Hz), 7.85 (1H, s), 8.55 (1H, s).

IR (KBr) v: 2955, 2934, 2867, 1682, 1669 cm⁻¹.

Reference Example 47

[0156] A mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g), 4-[N-(2-ethoxyethyl)-N-methylamino]phenyl borate (0.17g), potassium carbonate (0.2g), water (1.1ml), ethanol (1.1ml) and toluene (10.7ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.03g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium

sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-[N-(2-ethoxyethyl)-N-methylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.22g) as colorless amorphous.

¹H-NMR (δ ppm, CDCl₃) 1.21 (3H, t, J = 7.0 Hz), 2.91 - 2.97 (2H, m), 3.05 (3H, s), 3.52 (2H, q, J = 7.0 Hz), 3.58 - 3.63 (4H, m), 3.81 - 3.88 (2H, m), 3.84 (3H, s), 6.81 (2H, d, J = 8.8 Hz), 7.14 (1H, d, J = 8.2 Hz), 7.46 - 7.57 (3H, m), 7.67 (1H, d, J = 2.0 Hz), 7.75 (1H, s), 8.52 (1H, s).

IR (KBr) v: 1707, 1678, 1610, 1503, 1358, 1261, 1234, 1196 cm⁻¹.

Reference Example 48

[0157] In methanol (6.6ml) and THF (4.4ml) was dissolved methyl 7-[4-[N-(2-ethoxyethyl)-N-methylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.22g). To the solution was added 1N sodium hydroxide solution (2.2ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-[N-(2-ethoxyethyl)-N-methylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.18g) as colorless amorphous.

¹H-NMR (δ ppm, CDCl₃) 1.10 (3H, t, J = 7.4 Hz), 2.68 - 2.81 (2H, m), 2.97 (3H, s), 3.26 - 3.38 (2H, m), 3.44 (2H, q, J = 7.0 Hz), 3.54 (3H, s), 3.68 - 3.73 (2H, m), 6.79 (2H, d, J = 8.8 Hz), 7.36 (1H, d, J = 8.8 Hz), 7.56 - 7.73 (4H, m), 7.86 (1H, s), 8.52 (1H, s).

IR (KBr) v: 2975, 2876, 1678, 1611, 1503, 1312, 1431, 1292, 1273, 1194, 1117, 810 cm⁻¹.

Reference Example 49

[0158] A mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g), 4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl borate (0.46g), 1M potassium carbonate solution (3.2ml), ethanol (3.2ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.03g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.23g) as green amorphous.

¹H-NMR (δ ppm, CDCl₃) 1.17 - 1.26 (6H, m), 2.94 (2H, t, J = 4.8 Hz), 3.42 - 3.64 (8H, m), 3.82 - 3.87 (5H, m), 6.78 (2H, d, J = 8.8 Hz), 7.13 (1H, d, J = 8.1 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.54 (1H, dd, J = 2.1, 8.1 Hz), 7.66 (1H, d, J = 2.1 Hz), 7.75 (1H, s), 8.51 (1H, s).

IR (KBr) v: 2973, 2868, 1709, 1678 cm⁻¹.

Reference Example 50

[0159] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.23g). To the solution was added 1N sodium hydroxide solution (5.5ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g) as pale green crystals.

mp 182 - 184°C.

¹H-NMR (δ ppm, CDCl₃) 1.17 - 1.30 (6H, m), 2.97 (2H, t, J = 5.7 Hz), 3.43 - 3.65 (8H, m), 3.87 (2H, t, J = 5.7 Hz), 6.79 (2H, d, J = 8.8 Hz), 7.16 (1H, d, J = 8.4 Hz), 7.48 (2H, d, J = 8.8 Hz), 7.58 (1H, dd, J = 2.0, 8.4 Hz), 7.68 (1H, d, J = 2.0 Hz), 7.86 (1H, s), 8.54 (1H, s).

IR (KBr) v: 2973, 2872, 1682 cm⁻¹.

Reference Example 51

[0160] A mixture of methyl 7-bromo-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g), 4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl borate (0.3g), 1M potassium carbonate solution (2.5ml), ethanol (2.5ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.04g), and the mixture was refluxed overnight under argon atmosphere and

extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g) as green oil.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.21 (3H, t, J = 7.0 Hz), 1.59 - 1.66 (2H, m), 2.94 (2H, t, J = 5.2 Hz), 3.39 - 3.64 (8H, m), 3.82 - 3.87 (5H, m), 6.78 (2H, d, J = 9.0 Hz), 7.14 (1H, d, J = 8.2 Hz), 7.47 (2H, d, J = 9.0 Hz), 7.55 (1H, dd, J = 2.0, 8.2 Hz), 7.66 (1H, d, J = 2.0 Hz), 7.75 (1H, s), 8.52 (1H, s).

IR (neat) ν: 2942, 2867, 1709, 1682 cm⁻¹.

Reference Example 52

[0161] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g). To the solution was added 1N sodium hydroxide solution (7ml), and the mixture was stirred at 60°C for 1.5 hours and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.29g) as pale yellow crystals.

mp 169 - 171°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.5 Hz), 1.21 (3H, t, J = 7.0 Hz), 1.56 - 1.66 (2H, m), 2.96 (2H, t, J = 5.0 Hz), 3.39 - 3.62 (8H, m), 3.87 (2H, t, J = 5.0 Hz), 6.78 (2H, d, J = 8.8 Hz), 7.16 (1H, d, J = 8.0 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.58 (1H, dd, J = 2.0, 8.0 Hz), 7.68 (1H, d, J = 2.0 Hz), 7.84 (1H, s), 8.54 (1H, s).

IR (KBr) ν: 2967, 2870, 1680 cm⁻¹.

Reference Example 53

[0162] In THF (50ml) were dissolved methyl 7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.7g) and pyridine (1.2ml). To the solution was added methanesulfonic anhydride (1.5g), and the mixture was stirred under nitrogen atmosphere at 50 for 3 hours. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-methanesulfonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g) as pale yellow crystals.

mp 224 - 226°C (dec.).

¹H-NMR (δ ppm, CDCl₃) 2.78 (3H, s), 3.05 (2H, t, J = 5.0 Hz), 3.21 - 3.26 (4H, m), 3.85 - 3.92 (9H, m), 6.99 (2H, d, J = 9.2 Hz), 7.50 - 7.58 (3H, m), 7.63 - 7.69 (2H, m), -7.80 (1H, s).

IR (KBr) ν: 2953, 1709 cm⁻¹.

Reference Example 54

[0163] In methanol (100ml) and THF (100ml) was dissolved methyl 1-methanesulfonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was stirred at room temperature overnight. To the mixture was added 1N sodium hydroxide solution (5ml), and the mixture was stirred at 60°C for 1.5 hours and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 1-methanesulfonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.36g) as pale yellow crystals.

mp 264 - 275°C (dec.).

¹H-NMR (δ ppm, CDCl₃ + CD₃OD) 2.79 (3H, s), 3.02 (2H, t, J = 5.1 Hz), 3.21 - 3.26 (4H, m), 3.84 - 3.92 (6H, m), 7.00 (2H, d, J = 8.8 Hz), 7.50 - 7.58 (3H, m), 7.64 - 7.68 (2H, m), 7.83 (1H, s).

IR (KBr) ν: 2969, 2832, 1671 cm⁻¹.

Anal. Calcd. for C₂₂H₂₄N₂O₅S: C, 61.66; H, 5.65; N, 6.54. Found C, 61.48; H, 5.81; N, 6.25.

Reference Example 55

[0164] In THF (25ml) were dissolved methyl 7-(4-ethoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) and pyridine (0.6ml). To the solution was added methanesulfonic anhydride (0.67g), and the mixture was stirred under nitrogen atmosphere at 40°C overnight. To the mixture was added methanesulfonic anhydride (0.13g), and the

mixture was stirred at 40°C for 4 hours. The solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-(4-ethoxyphenyl)-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.14g) as pale yellow crystals.

mp 175 - 181°C.

¹H-NMR (δ ppm, CDCl₃) 1.45 (3H, t, J = 7.1 Hz), 2.78 (3H, s), 3.05 (2H, t, J = 4.9 Hz), 3.84 - 3.89 (5H, m), 4.09 (2H, q, J = 7.1 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.49 - 7.57 (3H, m), 7.63 (1H, d, J = 2.2 Hz), 7.67 (1H, d, J = 8.4 Hz), 7.80 (1H, s). IR (KBr) v: 2984, 1711 cm⁻¹.

Reference Example 56

[0165] In methanol (25ml) and THF (25ml) was dissolved methyl 7-(4-ethoxyphenyl)-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.14g). To the solution was added 1N sodium hydroxide solution (3ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-(4-ethoxyphenyl)-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.13g) as pale yellow crystals.

mp 237 - 242°C (dec.).

¹H-NMR (δ ppm, CDCl₃) 1.46 (3H, t, J = 7.0 Hz), 2.81 (3H, s), 3.08 (2H, t, J = 5.9 Hz), 3.89 (2H, t, J = 5.9 Hz), 4.10 (2H, q, J = 7.0 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.58 (1H, dd, J = 2.0, 8.4 Hz), 7.65 (1H, d, J = 2.0 Hz), 7.70 (1H, d, J = 8.4 Hz), 7.91 (1H, s). IR (KBr) v: 2984, 1669 cm⁻¹.

Reference Example 57

[0166] In THF (30ml) were dissolved methyl 7-[4-(2-ethoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) and pyridine (0.5ml). To the solution was added methanesulfonic anhydride (0.6g), and the mixture was stirred under nitrogen atmosphere at 50°C overnight. To the mixture was added methanesulfonic anhydride (0.1g) and the mixture was stirred at 50°C for 2 hours. The solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-ethoxyethoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.13g) as pale yellow crystals.

mp 143 - 146°C.

¹H-NMR (δ ppm, CDCl₃) 1.27 (3H, t, J = 6.9 Hz), 2.78 (3H, s), 3.06 (2H, t, J = 5.2 Hz), 3.63 (2H, q, J = 6.9 Hz), 3.81 - 3.89 (7H, m), 4.19 (2H, t, J = 4.9 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.49 - 7.57 (3H, m), 7.64 (1H, d, J = 2.0 Hz), 7.68 (1H, d, J = 8.4 Hz), 7.81 (1H, s).

IR (KBr) v: 2932, 2872, 1709 cm⁻¹.

Reference Example 58

[0167] In methanol (20ml) and THF (20ml) was dissolved methyl 7-[4-(2-ethoxyethoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.13g). To the solution was added 1N sodium hydroxide solution (3ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(2-ethoxyethoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.12g) as pale yellow crystals.

mp 222 - 225°C.

¹H-NMR (δ ppm, CDCl₃) 1.27 (3H, t, J = 7.1 Hz), 2.81 (3H, s), 3.08 (2H, t, J = 5.1 Hz), 3.63 (2H, q, J = 7.1 Hz), 3.81 - 3.91 (4H, m), 4.19 (2H, t, J = 4.8 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.57 (1H, dd, J = 2.2, 9.0 Hz), 7.64 (1H, d, J = 2.2 Hz), 7.67 (1H, d, J = 9.0 Hz), 7.90 (1H, s).

IR (KBr) v: 2978, 2872, 1694, 1669 cm⁻¹.

Reference Example 59

[0168] In THF (35ml) were dissolved methyl 7-[4-(3-ethoxypropoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-car-

boxylate (0.4g) and pyridine (0.75ml). To the solution was added methanesulfonic anhydride (0.92g), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. To the mixture was added methanesulfonic anhydride (0.25g), and the mixture was stirred at 50°C overnight. The solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(3-ethoxypropoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.26g) as pale yellow crystals.

mp 127 - 129°C.

¹H-NMR (δ ppm, CDCl₃) 1.22 (3H, t, J = 7.0 Hz), 2.02 - 2.15 (2H, m), 2.78 (3H, s), 3.05 (2H, t, J = 5.5 Hz), 3.51 (2H, q, J = 7.0 Hz), 3.62 (2H, t, J = 6.2 Hz), 3.85 (3H, s), 3.86 (2H, t, J = 5.5 Hz), 4.12 (2H, t, J = 6.2 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.55 (1H, dd, J = 2.2, 8.4 Hz), 7.63 (1H, d, J = 2.2 Hz), 7.67 (1H, d, J = 8.4 Hz), 7.80 (1H, s).

IR (KBr) ν: 2951, 2872, 1711 cm⁻¹.

Reference Example 60

[0169] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(3-ethoxypropoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.22g). To the solution was added 1N sodium hydroxide solution (5ml), and the mixture was stirred at room temperature overnight and concentrated. To the residue was added water, and the mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(3-ethoxypropoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.23g) as pale yellow crystals.

mp 210 - 212°C.

¹H-NMR (δ ppm, CDCl₃) 1.22 (3H, t, J = 7.2 Hz), 2.03 - 2.15 (2H, m), 2.81 (3H, s), 3.08 (2H, t, J = 5.5 Hz), 3.52 (2H, q, J = 7.2 Hz), 3.63 (2H, t, J = 6.0 Hz), 3.89 (2H, t, J = 5.5 Hz), 4.13 (2H, t, J = 6.2 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.57 (1H, dd, J = 1.8, 8.4 Hz), 7.65 (1H, d, J = 1.8 Hz), 7.69 (1H, d, J = 8.4 Hz), 7.91 (1H, s).

IR (KBr) ν: 3036, 2870, 1671 cm⁻¹.

Anal. Calcd. for C₂₃H₂₇NO₆S: C, 62.00; H, 6.11; N, 3.14. Found C, 62.17; H, 5.99; N, 3.17.

Reference Example 61

[0170] In dimethyl carbonate (15ml) was dissolved 7-bromo-1,2,3,4-tetrahydro-1-benzazepin-5-one (0.68g). To the solution was added sodium methoxide (0.92g), and the mixture was refluxed under nitrogen atmosphere for 8 hours and poured into ice-water. To the mixture was added 1N hydrochloric acid, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give pale yellow oil (0.88g), which was dissolved in THF (30ml). To the solution was added sodium borohydride (0.1g) at -40°C and then was added dropwise methanol (3ml), and the mixture was stirred at -15°C for 1 hour. To the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was dissolved in THF (25ml), and to the solution was added triethylamine (0.7ml), and then was added dropwise, under ice-cooling, methanesulfonyl chloride (0.6ml). Under nitrogen atmosphere, the mixture was stirred at room temperature overnight, and to the mixture was added dropwise DBU (2.5ml) at room temperature. The mixture was refluxed for 30 minutes, and the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-bromo-1-methoxycarbonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) as colorless crystals.

mp 135 - 136°C.

¹H-NMR (δ ppm, CDCl₃) 2.92 (2H, t, J = 5.1 Hz), 3.70 (2H, br), 3.74 (3H, s), 3.82 (3H, s), 7.26 (1H, br), 7.42 (1H, dd, J = 2.2, 8.4 Hz), 7.56 - 7.57 (2H, m).

IR (KBr) ν: 2951, 1713 cm⁻¹.

Anal. Calcd. for C₁₄H₁₄BrNO₄: C, 49.43; H, 4.15; N, 4.12. Found C, 49.53; H, 4.08; N, 4.06.

Reference Example 62

[0171] A mixture of methyl 7-bromo-1-methoxycarbonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g), 4-mor-

pholinophenyl borate (0.22g), 1M potassium carbonate solution (2.5ml), ethanol (2.5ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.04g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-methoxycarbonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g) as pale yellow crystals.

mp 216 - 220°C.

¹H-NMR (δ ppm, CDCl₃) 2.94 (2H, t, J = 5.4 Hz), 3.20 - 3.25 (4H, m), 3.75 (2H, br), 3.76 (3H, br), 3.83 (3H, s), 3.87 - 3.92 (4H, m), 6.99 (2H, d, J = 9.0 Hz), 7.39 (1H, br), 7.50 - 7.55 (3H, m), 7.60 (1H, s), 7.73 (1H, s).

IR (KBr) v: 2953, 1713 cm⁻¹.

Anal. Calcd. for C₂₄H₂₆N₂O₅·0.2H₂O: C, 67.65; H, 6.25; N, 6.57. Found C, 67.50; H, 6.10; N, 6.58.

Reference Example 63

[0172] In methanol (40ml) and THF (60ml) was dissolved methyl 1-methoxycarbonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g). To the solution was added 1N sodium hydroxide solution (5ml), and the mixture was stirred at room temperature overnight. To the mixture was added 1N sodium hydroxide solution (2.5ml), and the mixture was stirred at room temperature overnight and concentrated. The residue was neutralized with 1N hydrochloric acid, precipitated crystals were filtered and washed with water to give 1-methoxycarbonyl-7-(4-morpholinophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.29g) as colorless crystals.

mp 274 - 279°C (dec.).

¹H-NMR (δ ppm, DMSO-d₆) 2.78 (2H, t-like), 3.16 - 3.18 (4H, m), 3.60 (2H, br), 3.66 (3H, s), 3.75 - 3.77 (4H, m), 7.03 (2H, d, J = 8.6 Hz), 7.40 (1H, d, J = 8.4 Hz), 7.58 - 7.69 (4H, m), 7.79 (1H, s), 12.65 (1H, br).

IR (KBr) v: 2969, 1705, 1678 cm⁻¹.

Anal. Calcd. for C₂₃H₂₄N₂O₅·0.5H₂O: C, 66.17; H, 6.04; N, 6.71. Found C, 66.15; H, 5.74; N, 6.68.

Reference Example 64

[0173] In pyridine (10.0ml) were dissolved ethyl 4-(4-bromo-2-formylphenyl)aminobutyrate (3.16g) and tosyl chloride (2.88g), and the mixture was stirred at 50°C for 62 hours. The mixture was diluted with ethyl acetate, washed with 1N hydrochloric acid and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (150g, hexane : ethyl acetate = 6 : 1 → 4:1) to give ethyl 4-(4-bromo-2-formylphenyl)-4-[(4-methylphenyl)sulfonyl]aminobutyrate (1.47g, 31%) as brown oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.23 (3H, t, J = 7.0 Hz), 1.77 (2H, quint, J = 7.2 Hz), 2.35 (2H, t, J = 7.1 Hz), 2.45 (3H, s), 3.27 - 3.38 (1H, m), 3.88 - 3.96 (1H, m), 4.09 (2H, q, J = 6.9 Hz), 6.60 (1H, d, J = 8.6 Hz), 7.29 (2H, d, J = 9.2 Hz), 7.44 (2H, d, J = 8.4 Hz), 7.59 (1H, dd, J = 8.5, 2.5 Hz), 8.15 (1H, d, J = 2.6 Hz), 10.35 (1H, s).

IR (KBr) 1732, 1694, 1474, 1377, 1350, 1184, 1163, 723, 655, 579 cm⁻¹.

Reference Example 65

[0174] In a mixture of t-butanol and toluene (1:10, v/v, 66.0ml) was dissolved ethyl 4-(4-bromo-2-formylphenyl)-4-[(4-methylphenyl)sulfonyl]aminobutyrate (1456mg). To the solution was added at room temperature potassium t-butoxide (384mg), and the mixture was stirred at 100°C for 1 hour. To the mixture was added 1N hydrochloric acid to convert weakly acidic solution, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (75g, hexane : ethyl acetate = 6 : 1) to give ethyl 7-bromo-1-[(4-methylphenyl)sulfonyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (413mg, 30%) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 1.29 (3H, t, J = 7.2 Hz), 2.35 (3H, s), 2.86 (2H, td, J = 5.8, 1.4 Hz), 3.87 (2H, t, J = 6.1 Hz), 4.19 (2H, q, J = 7.1 Hz), 7.13 (2H, d, J = 8.0 Hz), 7.15 - 7.19 (1H, m), 7.39 - 7.55 (5H, m).

IR (KBr) 1709, 1485, 1350, 1246, 1194, 1163, 1090, 710, 696, 662 cm⁻¹.

Reference Example 66

[0175] In a mixture of water : ethanol : toluene (1 : 1 : 10 v/v, 18.0ml) were dissolved 4-(4-morpholino)phenyl borate (278mg) and ethyl 7-bromo-1-[(4-methylphenyl)sulfonyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (403mg). To

the solution was added potassium carbonate (297mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenyl)phosphinepalladium (41mg), and the mixture was refluxed under argon atmosphere for 13 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (45g, hexane : ethyl acetate = 4 : 1 → 3 : 1) to give ethyl 7-[(4-methylphenyl)sulfonyl]-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-

4-carboxylate (460mg, 96%) as yellow crystals.
¹H-NMR (200 MHz, CDCl₃) δ 1.30 (3H, t, J = 7.2 Hz), 2.34 (3H, s), 2.87 (2H, t, J = 5.3 Hz), 3.23 (4H, t, J = 4.9 Hz), 3.90 (4H, t, J = 4.8 Hz), 3.90 - 3.95 (2H, m), 4.20 (2H, q, J = 7.1 Hz), 6.99 (2H, d, J = 9.0 Hz), 7.12 (2H, d, J = 8.2 Hz), 7.36 (1H, s), 7.45 (2H, d, J = 8.4 Hz), 7.53 (2H, d, J = 8.6 Hz), 7.46 - 7.68 (3H, m).
 IR (KBr) 1705, 1609, 1493, 1348, 1233, 1161, 1123, 1092, 932, 818, 671 cm⁻¹.

Reference Example 67

[0176] In THF (10.0ml) was dissolved methyl 7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (369mg), and to the solution were added pyridine (0.11ml) and acetyl chloride (0.086ml) at room temperature or at 0°C. The mixture was stirred at room temperature for 30 minutes, and diluted with ethyl acetate and washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure to give methyl 1-acetyl-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (400mg, 97%) as pale yellow amorphous.
¹H-NMR (200 MHz, CDCl₃) δ 2.05 (3H, s), 2.74 - 3.19 (3H, m), 3.24 (4H, t, J = 4.8 Hz), 3.83 (3H, s), 3.90 (4H, t, J = 4.8 Hz), 4.73 - 4.85 (1H, m), 7.01 (2H, d, J = 8.8 Hz), 7.23 (1H, d, J = 8.2 Hz), 7.54 (2H, d, J = 8.8 Hz), 7.51 - 7.56 (1H, m), 7.67 (1H, d, J = 1.8 Hz), 7.74 (1H, s).
 IR (KBr) 1709, 1659, 1609, 1497, 1389, 1233, 1123 cm⁻¹.

Reference Example 68

[0177] In a mixture of THF and ethanol (1:1, v/v, 10.0ml) was dissolved methyl 1-acetyl-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (394mg). To the solution was added 1N sodium hydroxide solution (3.0ml), and the mixture was stirred at room temperature for 12 hours. To the mixture was added 1N hydrochloric acid (3.0ml), and the mixture was stirred at room temperature for 12 hours. The mixture was extracted with ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give 1-acetyl-7-[4-(4-morpholino)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (372mg, 98%) as pale yellow crystals.
¹H-NMR (200 MHz, DMSO-d₆) δ 1.95 (3H, s), 2.75 (3H, br), 3.17 (4H, t, J = 4.7 Hz), 3.76 (4H, t, J = 4.8 Hz), 4.54 (1H, br), 7.03 (2H, d, J = 8.8 Hz), 7.46 (1H, d, J = 8.2 Hz), 7.63 - 7.72 (4H, m), 7.88 (1H, s).

Reference Example 69

[0178] In THF (500ml) was dissolved methyl anthranilate (247.8g, 130mmol). To the solution were added pyridine (205.7g, 2.60ml) and tosyl chloride (260.2g, 1.37mol) at room temperature, and the mixture was stirred for 14.5 hours (overnight). To the mixture were added ethyl acetate and water to carry out extraction, and the organic layer was washed with 1N hydrochloric acid, water and saturated brine, and dried with anhydrous magnesium sulfate. Under reduced pressure, the solvent was evaporated to give crystals which were washed with ethyl acetate and IPE (isopropyl ether) to give white crystals of methyl N-tosylanthranilate (348.0g). The mother liquor was treated by the same procedure to give methyl N-tosylanthranilate (32.4g).
 Yield, 380.4 g (96%).
 mp 111 - 112°C.
¹H-NMR (CDCl₃, 200 MHz) δ 2.36 (3H, s), 3.88 (3H, s), 7.03 (1H, td, J = 7.6, 1.7 Hz), 7.22 (2H, d, J = 8.0 Hz), 7.45 (1H, td, J = 7.9, 1.5 Hz), 7.67 - 7.78 (1H, m), 7.75 (2H, d, J = 8.4 Hz), 7.92 (1H, dd, J = 8.0, 1.6 Hz), 10.63 (1H, brs).
 IR (KBr) 3173, 1688, 1493, 1260, 1161, 1090, 567 cm⁻¹.

Reference Example 70

[0179] In 85% acetic acid solution (1000ml) were suspended methyl N-tosylanthranilate (100g, 328mmol) and sodium acetate (29.6g, 361mmol). To the solution was added dropwise at room temperature a solution of bromine (21.0ml, 408mmol) in 85% acetic acid solution (100ml), and the mixture was stirred at 70°C for 2 hours. To the mixture was added sodium thiosulfate pentahydrate at room temperature, and excess bromine was reduced. The mixture was concentrated under reduced pressure, and to the residue were added water and ethyl acetate. The separated organic

layer was washed with potassium carbonate solution and saturated brine and dried with anhydrous magnesium sulfate. Under reduced pressure, the solvent was evaporated to give crystals, which were washed with IPE to give white crystals of methyl 5-bromo-N-tosylanthranilate (116.9g). The mother liquor was treated by the same procedure to give methyl 5-bromo-N-tosylanthranilate (6.9g).

5 Yield, 123.5g (98%).

mp 123 - 124°C.

¹H-NMR (CDCl₃, 200 MHz) δ 2.38 (3H, s), 3.89 (3H, s), 7.24 (2H, d, J = 9.2 Hz), 7.53 (1H, dd, J = 8.8, 2.2 Hz), 7.61 (1H, d, J = 8.6 Hz), 7.73 (2H, d, J = 8.0 Hz), 8.03 (1H, d, J = 2.2 Hz), 10.52 (1H, brs).

10 Reference Example 71

[0180] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 42.0ml) were dissolved 4-propoxyphenyl borate (746mg) and methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1320mg). To the solution was added potassium carbonate (1145mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (160mg), and the mixture was heated to reflux under argon atmosphere for 14.5 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure; and the residue was purified with silica gel column chromatography (75g, hexane : ethyl acetate = 3 : 1) to give methyl 1-(t-butoxycarbonyl)-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate as yellow amorphous. The obtained methyl 1-(t-butoxycarbonyl)-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate was dissolved in ethyl acetate (80ml). To the solution was added 6N hydrochloric acid (20ml) at room temperature, and the mixture was stirred at 100°C for 30 minutes and neutralized with 1N sodium hydroxide and saturated sodium hydrogen carbonate solution. The separated organic layer was washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (94/mg) as yellow crystals. The mother liquor was concentrated, and the residue was purified with silica gel column chromatography (15g/ hexane:ethyl acetate=4:1) to give desired product (147mg).

Yield, 1094mg (94%).

30 mp 134 - 137°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.05 (3H, t, J = 8.1 Hz), 1.83 (2H, sextet, J = 7.0 Hz), 2.88 (2H, t, J = 4.4 Hz), 3.40 (2H, t, J = 4.8 Hz), 3.81 (3H, s), 3.96 (2H, t, J = 6.6 Hz), 6.67 (1H, d, J = 8.4 Hz), 6.90 - 6.98 (2H, m), 7.32 (1H, dd, J = 8.4, 2.2 Hz), 7.45 (2H, d, J = 8.4 Hz), 7.46 (1H, d, J = 1.8 Hz), 7.73 (1H, s).

IR (KBr) 3384, 2963, 1698, 1609, 1499, 1269, 1242, 1209, 1177, 818 cm⁻¹.

35 Anal. Calcd. for C₂₁H₂₃NO₃ (0.1H₂O additive): C, 74.36; H, 6.89; N, 4.13. Found C, 74.31; H, 6.81; N, 4.10.

Reference Example 72

[0181] To anhydrous acetic acid (0.65ml) was added formic acid (0.32ml) at 0°C, and the mixture was stirred at 60°C for 2 hours, air-cooled and diluted with THF (10ml). In THF (10ml) was dissolved methyl 7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (520mg), and the solution was added dropwise to the previously prepared solution of formic anhydride in THF, at 0°C. The mixture was stirred at room temperature for 1.5 hours. The solvent was evaporated under reduced pressure, and the residue was diluted with ethyl acetate, washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 1-formyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (563mg) as white crystals.

mp 151.5 - 153°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.07 (3H, t, J = 7.5 Hz), 1.85 (2H, sextet, J = 7.1 Hz), 2.92 (2H, t, J = 5.1 Hz), 3.84 (3H, s), 3.85 (2H, t, J = 5.5 Hz), 3.98 (2H, t, J = 6.6 Hz), 6.98 - 7.02 (2H, m), 7.17 (1H, d, J = 8.0 Hz), 7.48 - 7.54 (2H, m), 7.56 (1H, dd, J = 8.2, 2.2 Hz), 7.68 (1H, d, J = 2.0 Hz), 7.76 (1H, s), 8.53 (1H, s).

50 IR (KBr) 1709, 1678, 1497, 1358, 1236, 1192, 824 cm⁻¹.

Anal. Calcd. for C₂₂H₂₃NO₄: C, 72.31; H, 6.34; N, 3.83. Found C, 72.35; H, 6.45; N, 3.83.

Reference Example 73

55

[0182] In THF (15.0ml) was dissolved methyl 7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (431mg). To the solution was added pyridine (1.0ml) and then was added a solution of methanesulfonic anhydride (1.11g) in THF (5.0 ml), at room temperature, and the mixture was stirred at 50°C for 15 hours. The mixture was diluted

with ethyl acetate, and washed with water, 1N hydrochloric acid, water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate to give methyl 1-methylsulfonyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (238mg) as white crystals. The mother liquor was concentrated, and the residue was purified with silica gel column chromatography (15g, hexane : ethyl acetate = 2 : 1) to give desired product. The obtained methyl 1-methylsulfonyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate was collected and dissolved in a mixture of THF and ethanol (1 : 1, v/v, 40ml). To the solution was added 1N sodium hydroxide solution (14.0ml and the mixture was stirred at room temperature for 18 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 1-methylsulfonyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (273mg, 53%) as white crystals.

mp 261 - 263°C (dec.).
¹H-NMR (200 MHz, DMSO-d₆) δ 1.00 (3H, t, J = 7.3 Hz), 1.76 (2H, sextet, J = 7.0 Hz), 2.91 (2H, t-like), 3.08 (3H, s), 3.71 (2H, t-like), 3.98 (2H, t, J = 6.6 Hz), 7.02 (2H, d, J = 8.6 Hz), 7.51 (1H, d, J = 8.4 Hz), 7.61 - 7.65 (1H, m), 7.67 (2H, d, J = 8.8 Hz), 7.75 (1H, s), 7.86 (1H, d, J = 1.4 Hz).
 IR (KBr) 1669, 1499, 1435, 1341, 1273, 1248, 1144, 970, 824, 787 cm⁻¹.
 Anal. Calcd. for C₂₁H₂₃NO₅S (0.2H₂O additive): C, 62.27; H, 5.82; N, 3.46. Found C, 62.17; H, 5.87; N, 3.45.

Reference Example 74

[0183] In a mixture of THF and ethanol (1 : 1, v/v, 24.0ml) was dissolved methyl 1-formyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (501mg). To the solution was added 1N sodium hydroxide solution (15.0ml), and the mixture was stirred at room temperature for 16 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 1-formyl-7-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (482mg) as white crystals.

mp 215 - 217°C.
¹H-NMR (200 MHz, DMSO-d₆) δ 1.03 (3H, t, J = 7.4 Hz), 1.71 - 1.84 (2H, m), 2.79 (2H, t, J = 5.4 Hz), 3.75 (2H, t, J = 5.6 Hz), 3.98 (2H, t, J = 6.5 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.34 (1H, d, J = 8.4 Hz), 7.59 - 7.65 (3H, m), 7.73 (1H, s), 7.82 (1H, d, J = 1.6 Hz), 8.53 (1H, s).
 IR (KBr) 1701, 1682, 1644, 1501, 1366, 1294, 1256, 1233, 1186, 820 cm⁻¹.
 Anal. Calcd. for C₂₁H₂₁NO₄: C, 71.78; H, 6.02; N, 3.99. Found C, 72.08; H, 6.12; N, 4.06.

Reference Example 75

[0184] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 42.0ml) were dissolved 4-ethoxy-3-fluorophenyl borate (754mg) and methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1305mg). To the solution was added potassium carbonate (1132mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (158mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (75g, hexane : ethyl acetate = 4 : 1) to give methyl 1-(t-butoxycarbonyl)-7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate as yellow amorphous. The obtained methyl 1-(t-butoxycarbonyl)-7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1-(t-butoxycarbonyl)-7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate was dissolved in ethyl acetate (80ml). To the solution was added 1N hydrochloric acid (15ml) at room temperature, and the mixture was stirred at 100°C for 1 hour and neutralized with 1N sodium hydroxide and saturated sodium hydrogen carbonate solution. To the mixture was added ethyl acetate, and the separated organic layer was washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (50g, hexane : ethyl acetate = 9 : 1 → 4 : 1 → 2 : 1) to give methyl 7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1007mg, 86%) as yellow crystals.

mp 134 - 137°C.
¹H-NMR (200 MHz, CDCl₃) δ 1.47 (3H, t, J = 7.0 Hz), 2.89 (2H, t, J = 4.4 Hz), 3.41 (2H, q, J = 4.8 Hz), 3.81 (3H, s), 4.14 (2H, q, J = 7.1 Hz), 4.63 (1H, brs), 6.67 (1H, d, J = 8.2 Hz), 6.94 - 7.03 (1H, m), 7.19 - 7.31 (3H, m), 7.44 (1H, d, J = 2.2 Hz), 7.71 (1H, s).

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IR (KBr) 3385, 1696, 1624, 1503, 1478, 1435, 1312, 1292, 1235, 1211, 1173 cm^{-1} .
 Anal. Calcd. for $\text{C}_{20}\text{H}_{20}\text{FNO}_3$: C, 70.37; H, 5.91; N, 4.10. Found C, 70.35; H, 5.73; N, 4.03.

Reference Example 76

- 5
 [0185] To anhydrous acetic acid (0.63ml) was added formic acid (0.31ml) at 0°C, and the mixture was stirred at 60°C for 2 hours, cooled and diluted with THF (10ml). In THF (10ml) was dissolved methyl 7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (510mg), and the solution was added dropwise to the previously prepared solution of formic anhydride in THF, at 0°C. The mixture was stirred at room temperature for 2 hours, and the solvent was evaporated under reduced pressure. The residue was diluted with ethyl acetate, washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 7-(4-ethoxy-3-fluorophenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (490mg, 89%) as white crystals.
 10
 mp 126 - 127.5°C.
 $^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 1.49 (3H, t, J = 7.0 Hz), 2.95 (2H, td, J = 5.5, 1.1 Hz), 3.83 - 3.88 (2H, m), 3.84 (3H, s), 4.17 (2H, q, J = 7.1 Hz), 7.05 (1H, t, J = 8.7 Hz), 7.19 (1H, d, J = 8.0 Hz), 7.28 - 7.37 (2H, m), 7.54 (1H, dd, J = 8.2, 2.2 Hz), 7.66 (1H, d, J = 2.2 Hz), 7.75 (1H, s), 8.54 (1H, s).
 IR (KBr) 1707, 1674, 1501, 1269, 1236 cm^{-1} .
 20
 Anal. Calcd. for $\text{C}_{21}\text{H}_{20}\text{FNO}_4$: C, 68.28; H, 5.46; N, 3.79. Found C, 68.18; H, 5.52; N, 3.70.

Reference Example 77

- [0186] In THF (10.0ml) was dissolved methyl 7-(4-ethoxy-3-fluorophenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (345mg). To the solution was added pyridine (0.82ml), and to the mixture was added a solution of methanesulfonic anhydride (550mg) in THF (5.0ml), at room temperature. The mixture was stirred at room temperature for 37.5 hours, diluted with ethyl acetate, and washed with water, 1N hydrochloric acid, water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 7-(4-ethoxy-3-fluorophenyl)-1-methylsulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (193mg) as white crystals. The mother liquor was concentrated, and the residue was purified with silica gel column chromatography (15g, hexane : ethyl acetate = 3 : 1) to give desired product. The obtained methyl 7-(4-ethoxy-3-fluorophenyl)-1-methylsulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate was collected and dissolved in a mixture of THF and ethanol (1 : 1, v/v, 10.0ml). To the solution was added 1N sodium hydroxide solution (3.6ml), and the mixture was stirred at room temperature for 16.5 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 7-(4-ethoxy-3-fluorophenyl)-1-methylsulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (213mg, 52%) as white crystals.
 40
 mp 237 - 239°C.
 $^1\text{H-NMR}$ (200 MHz, DMSO-d_6) δ 1.38 (3H, t, J = 7.0 Hz), 2.90 (2H, t, J = 5.4 Hz), 3.09 (3H, s), 3.70 (2H, t, J = 4.8 Hz), 4.16 (2H, q, J = 7.1 Hz), 7.23 (1H, d, J = 8.9 Hz), 7.50 - 7.56 (2H, m), 7.63 - 7.71 (2H, m), 7.76 (1H, s), 7.94 (1H, d, J = 1.6 Hz).
 IR (KBr) 1686, 1669, 1622, 1499, 1350, 1271, 1150, 970, 801, 783 cm^{-1} .
 45
 Anal. Calcd. for $\text{C}_{20}\text{H}_{20}\text{FNO}_5\text{S}$ (0.3H₂O additive): C, 58.47; H, 5.05; N, 3.41. Found C, 58.50; H, 4.94; N, 3.44.

Reference Example 78

- [0187] In a mixture of THF and ethanol (1 : 1, v/v, 20.0ml) was dissolved methyl 7-(4-ethoxy-3-fluorophenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (441mg). To the solution was added 1N sodium hydroxide solution (12.0ml), and the mixture was stirred at room temperature for 16 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 7-(4-ethoxy-3-fluorophenyl)-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (435mg) as white crystals. mp 220 - 222°C.
 50
 $^1\text{H-NMR}$ (200 MHz, DMSO-d_6) δ 1.37 (3H, t, J = 7.0 Hz), 2.74 (2H, t-like), 3.71 (2H, t-like), 4.16 (2H, q, J = 6.9 Hz), 7.24 (1H, t, J = 8.8 Hz), 7.41 (1H, d, J = 8.4 Hz), 7.53 - 7.58 (1H, m), 7.65 - 7.75 (3H, m), 7.99 (1H, d-like), 8.53 (1H, s).
 55

IR (KBr) 1705, 1655, 1499, 1362, 1304, 1292, 1273, 1231, 1217, 1196, 1134, 816 cm^{-1} .
 Anal. Calcd. for $\text{C}_{20}\text{H}_{18}\text{FNO}_4$ (0.2 H_2O additive): C, 66.92; H, 5.17; N, 3.90. Found C, 66.80; H, 5.28; N, 3.81.

Reference Example 79

[0188] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 36.0ml) were dissolved 4-[(2-methylthio)ethoxy]phenyl borate (760mg) and methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1141mg). To the solution was added potassium carbonate (990mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (138mg) and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (50g, hexane : ethyl acetate = 9 : 1 \rightarrow 4 : 1) to give methyl 1-(t-butoxycarbonyl)-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1370mg, 98%) as white crystals.

mp 142.5 - 143.5°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 1.50 (9H, s), 2.24 (3H, s), 2.89 - 2.95 (4H, m), 3.63 - 3.70 (2H, br), 3.84 (3H, s), 4.21 (2H, t, J = 6.8 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.46 - 7.58 (5H, m), 7.74 (1H, s).

IR (KBr) 1703, 1497, 1391, 1238, 1163 cm^{-1} .

Anal. Calcd. for $\text{C}_{26}\text{H}_{31}\text{NO}_5\text{S}$: C, 66.50; H, 6.65; N, 2.98. Found C, 66.27; H, 6.68; N, 3.04.

Reference Example 80

[0189] In ethyl acetate (80ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1320mg). To the solution was added 1N hydrochloric acid (15ml) at room temperature, and the mixture was stirred at 90°C for 1.5 hours and neutralized with 1N sodium hydroxide and saturated sodium hydrogen carbonate solution. To the mixture was added ethyl acetate, and the separated organic layer was washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (910mg) as yellow crystals. The mother liquor was concentrated under reduced pressure, and the residue was purified with silica gel column chromatography (20g, hexane : ethyl acetate = 4 : 1) to give methyl 7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (910mg) as yellow crystals. Yield, 1020mg (98%).

mp 114.5 - 117°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 2.24 (3H, s), 2.89 (2H, t, J = 4.2 Hz), 2.91 (2H, t, J = 6.8 Hz), 3.41 (2H, t, J = 4.7 Hz), 3.81 (3H, s), 4.20 (2H, t, J = 6.9 Hz), 4.63 - 4.72 (1H, br), 6.68 (1H, d, J = 8.4 Hz), 6.96 (2H, d, J = 8.8 Hz), 7.32 (1H, dd, J = 8.2, 2.2 Hz), 7.46 (1H, d, J = 2.6 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.73 (1H, s).

IR (KBr) 3380, 1698, 1609, 1499, 1269, 1244, 1209, 1174 cm^{-1}

Anal. Calcd. for $\text{C}_{21}\text{H}_{23}\text{NO}_3\text{S}$: C, 68.27; H, 6.27; N, 3.79. Found C, 68.16; H, 6.22; N, 3.75.

Reference Example 81

[0190] To anhydrous acetic acid (0.65ml) was added formic acid (0.32ml) at 0°C, and the mixture was stirred at 55°C for 2 hours, air-cooled and diluted with THF (10ml). In THF (15ml) was dissolved methyl 7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (565mg), and the solution was added dropwise to the previously prepared solution of formic anhydride in THF, at 0°C. The mixture was stirred at room temperature for 2 hours, and the solvent was evaporated under reduced pressure. The residue was diluted with ethyl acetate, washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 1-formyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (578mg, 95%) as white crystals. mp 160 - 162°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 2.24 (3H, s), 2.93 (2H, t, J = 6.7 Hz), 2.95 (2H, t, J = 4.6 Hz), 3.83 - 3.88 (2H, m), 3.84 (3H, s), 4.22 (2H, t, J = 6.8 Hz), 6.97 - 7.04 (2H, m), 7.18 (1H, d, J = 8.2 Hz), 7.49 - 7.55 (2H, m), 7.56 (1H, dd, J = 8.2, 2.2 Hz), 7.68 (1H, d, J = 1.8 Hz), 7.76 (1H, s), 8.53 (1H, s).

IR (KBr) 1705, 1673, 1607, 1497, 1435, 1358, 1236, 1192, 824 cm^{-1} .

Anal. Calcd. for $\text{C}_{22}\text{H}_{23}\text{NO}_4\text{S}$: C, 66.48; H, 5.83; N, 3.52. Found C, 66.23; H, 5.93; N, 3.41.

Reference Example 82

- [0191] In THF (10.0ml) were dissolved methyl 7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (374mg) and pyridine (0.82ml). To the solution was added a solution of methanesulfonic anhydride (882mg) in THF (5.0ml), at room temperature, and the mixture was stirred at 50°C for 13 hours. The mixture was diluted with ethyl acetate, and washed with water, 1N hydrochloric acid, water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, hexane : ethyl acetate = 4 : 1 → 1 : 1) to give crystals, which were washed with ethyl acetate/hexane to give methyl 1-methylsulfonyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (201mg, 44%) as white crystals. mp 157 - 159°C.
- ¹H-NMR (200 MHz, CDCl₃) δ 2.24 (3H, s), 2.78 (3H, s), 2.92 (2H, t, J = 6.8 Hz), 3.05 (2H, td-like, J = 5.4 Hz (t)), 3.86 (3H, s), 3.87 (2H, t, J = 5.9 Hz), 4.22 (2H, t, J = 6.7 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.49 - 7.57 (3H, m), 7.64 (1H, d, J = 2.0 Hz), 7.68 (1H, d, J = 8.4 Hz), 7.81 (1H, s).
- IR (KBr) 1709, 1493, 1343, 1248, 1155 cm⁻¹.
- Anal. Calcd. for C₂₂H₂₅NO₅S₂: C, 59.04; H, 5.63; N, 3.13. Found C, 58.91; H, 5.65; N, 3.08.

Reference Example 83

- [0192] In a mixture of THF and ethanol (1 : 1, v/v, 40.0ml) was dissolved methyl 1-formyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (531mg). To the solution was added 1N sodium hydroxide solution (13.5ml), and the mixture was stirred at room temperature for 14 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 1-formyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (470mg, 92%) as white crystals.
- mp 199 - 201°C.
- ¹H-NMR (200 MHz, DMSO-d₆) δ 2.18 (3H, s), 2.76 (2H, t-like), 2.87 (2H, t, J = 6.6 Hz), 3.72 (2H, t-like), 4.21 (2H, t, J = 6.2 Hz), 7.04 (2H, d, J = 8.8 Hz), 7.40 (1H, d, J = 8.8 Hz), 7.67 - 7.74 (4H, m), 7.91 (1H, s), 8.53 (1H, s).
- IR (KBr) 1688, 1671, 1501, 1422, 1364, 1292, 1256, 1194, 1182, 1019, 822 cm⁻¹.
- Anal. Calcd. for C₂₂H₂₁NO₄S: C, 65.78; H, 5.52; N, 3.65. Found C, 65.49; H, 5.62; N, 3.58.

Reference Example 84

- [0193] In a mixture of THF and ethanol (1 : 1, v/v, 20.0ml) was dissolved methyl 1-methylsulfonyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (169mg). To the solution was added 1N sodium hydroxide solution (5.5ml), and the mixture was stirred at room temperature for 14 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give 1-methylsulfonyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (157mg, 96%) as white crystals.
- mp 234 - 239°C (dec.).
- ¹H-NMR (200 MHz, DMSO-d₆) δ 2.17 (3H, s), 2.87 (2H, t, J = 6.6 Hz), 2.90 (2H, t-like), 3.08 (3H, s), 3.70 (2H, t-like), 4.21 (2H, t, J = 6.6 Hz), 7.05 (2H, d, J = 8.8 Hz), 7.51 (1H, d, J = 8.0 Hz), 7.61 - 7.75 (4H, m), 7.86 (1H, d-like). IR (KBr) 1669, 1495, 1437, 1343, 1271, 1250, 1240, 1144, 824, 517 cm⁻¹.
- Anal. Calcd. for C₂₁H₂₃NO₅S₂: C, 58.18; H, 5.35; N, 3.23. Found C, 58.39; H, 5.39; N, 3.17.

Reference Example 85

- [0194] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 42.0ml) were dissolved 4-(2-propoxy)ethoxyphenyl borate (920mg) and methyl 7-bromo-1-(t-butoxycarbonyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1308mg). To the solution was added potassium carbonate (1135mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (119mg), and the mixture was heated to reflux under argon atmosphere for 14.5 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (50g, hexane : ethyl acetate = 9 : 1 → 3 : 1) to give methyl 1-(t-butoxycarbonyl)-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-ben-

zazepine-4-carboxylate (1536mg, 93%) as colorless oil.
¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.4 Hz), 1.49 (9H, s), 1.66 (2H, sextet, J = 7.1 Hz), 2.91 (2H, t, J = 4.7 Hz), 3.52 (2H, t, J = 6.7 Hz), 3.55 - 3.82 (2H, br), 3.82 (2H, t, J = 4.9 Hz), 3.83 (3H, s), 4.18 (2H, t, J = 4.9 Hz), 7.01 (2H, d, J = 8.8 Hz), 7.45 - 7.58 (5H, m), 7.74 (1H, s).
 IR (KBr) 1705, 1497, 1391, 1287, 1236, 1163, 1086 cm⁻¹.

Reference Example 86

[0195] In ethyl acetate (80ml) was dissolved methyl 1-(t-butoxycarbonyl)-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1536mg). To the solution was added 1N hydrochloric acid (20ml) at room temperature, and the mixture was stirred at 90°C for 1 hour and neutralized with saturated sodium hydrogen carbonate solution, and to the mixture was added ethyl acetate. The separated organic layer was washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (523mg) as yellow crystals. The mother liquor was concentrated under reduced pressure, and the residue was purified with silica gel column chromatography (65g, hexane : ethyl acetate = 3 : 1) to give methyl 7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (606mg) as yellow crystals. Yield, 1129mg (93%).

mp 86 - 88°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.4 Hz), 1.65 (2H, sextet, J = 7.2 Hz), 2.89 (2H, t, J = 4.5 Hz), 3.40 (2H, brs), 3.51 (2H, t, J = 6.8 Hz), 3.81 (3H, s and 2H, t, J = 4.9 Hz), 4.16 (2H, t, J = 5.0 Hz), 4.60 (1H/ brs), 6.67 (1H, d, J = 8.4 Hz), 6.95 - 7.01 (2H, m), 7.32 (1H, dd, J = 8.2, 2.2 Hz), 7.42 - 7.48 (2H, m), 7.46 (1H/ d, J = 2.0 Hz), 7.73 (1H, s).
 IR (KBr) 3380, 1698, 1611, 1501, 1269, 1246, 1209, 1177, 820 cm⁻¹.

Anal. Calcd. for C₂₃H₂₇NO₄: C, 72.42; H, 7.13; N, 3.67. Found C, 72.28; H, 7.09; N, 3.73.

Reference Example 87

[0196] To anhydrous acetic acid (0.5ml) was added formic acid, (0.25ml) at 0°C, and the mixture was stirred at 55°C for 2 hours, air-cooled and diluted with THF (10ml). In THF (15ml) was dissolved methyl 7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (462mg), and the solution was added dropwise to the previously prepared solution of formic anhydride in THF, at 0°C. The mixture was stirred at room temperature for 2 hours, and the solvent was evaporated under reduced pressure. The residue was diluted with ethyl acetate, washed with saturated sodium hydrogen carbonate solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/hexane to give methyl 1-formyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (496mg) as white crystals.

mp 107 - 108°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.3 Hz), 1.62 (2H, sextet, J = 7.2 Hz), 2.95 (2H, t, J = 4.7 Hz), 3.52 (2H, t, J = 6.7 Hz), 3.80 - 3.88 (4H, m), 3.84 (3H, s), 4.18 (2H, t, J = 4.9 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.17 (1H, d, J = 8.0 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.56 (1H, dd, J = 8.0, 2.2 Hz), 7.68 (1H, d, J = 1.8 Hz), 7.75 (1H, s), 8.53 (1H, s). IR (KBr) 1709, 1678, 1360, 1291, 1236, 1192, 824 cm⁻¹.

Anal. Calcd. for C₂₄H₂₇NO₅: C, 70.40; H, 6.65; N, 3.42. Found C, 70.37; H, 6.64; N, 3.41.

Reference Example 88

[0197] In THF (20.0ml) were dissolved methyl 7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (600mg) and pyridine (1.53ml). To the solution was added a solution of methanesulfonic anhydride (1.64g) in THF (10.0ml), at room temperature, and the mixture was stirred at 50°C for 14.5 hours. The mixture was diluted with ethyl acetate, and washed with water, 1N hydrochloric acid, water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (35g, hexane : ethyl acetate = 4 : 1 → 2 : 1) to give crystals, which were washed with ethyl acetate/hexane to give methyl 1-methylsulfonyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (231mg) as white crystals. The mother liquor was concentrated under reduced pressure, and the residue was purified with silica gel column chromatography (350g, hexane : ethyl acetate = 3 : 1 → 2 : 1) to give methyl 1-methylsulfonyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (170mg) as white crystals.

Yield, 402mg (56%).

mp 119 - 121°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.4 Hz), 1.65 (2H, sextet, J = 7.3 Hz), 2.78 (3H, s), 3.05 (2H, t, J = 5.5 Hz), 3.52 (2H, t, J = 6.8 Hz), 3.80 - 3.89 (4H, m), 3.85 (3H, s), 4.18 (2H, t, J = 5.0 Hz), 7.02 (2H, d, J = 8.8 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.54 (1H, dd, J = 8.4, 2.2 Hz), 7.63 (1H, d, J = 1.8 Hz), 7.67 (1H, d, J = 8.4 Hz), 7.80 (1H, s). IR (KBr) 1709, 1493, 1345, 1289, 1248, 1188, 1155, 1132, 1103 cm⁻¹.

5 Anal. Calcd. for C₂₄H₂₉NO₆S (0.4H₂O additive): C, 61.76; H, 6.44; N, 3.00. Found C, 61.61; H, 6.22; N, 2.96.

Reference Example 89

10 [0198] In a mixture of THF and ethanol (1 : 1, v/v, 30.0ml) was dissolved methyl 1-formyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (445mg). To the solution was added 1N sodium hydroxide solution (11.0ml), and the mixture was stirred at room temperature for 13 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/

15 hexane to give 1-formyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (430mg) as white crystals.

mp 165 - 166°C.

¹H-NMR (200 MHz, DMSO-d₆) δ 0.88 (3H, t, J = 7.5 Hz), 1.54 (2H, sextet, J = 7.1 Hz), 2.75 (2H, t-like), 3.43 (2H, t, J = 6.8 Hz), 3.72 (4H, t, J = 4.6 Hz), 4.15 (2H, t, J = 4.6 Hz), 7.04 (2H, d, J = 8.8 Hz), 7.40 (1H, d, J = 8.0 Hz), 7.69 (2H, d, J = 8.8 Hz), 7.67 - 7.74 (2H, m), 7.92 (1H, d, J = 1.8 Hz), 8.53 (1H, s).

20 IR (KBr) 1682, 1499, 1360, 1291, 1258, 1246, 1192, 1130, 820 cm⁻¹.

Anal. Calcd. for C₂₃H₂₅NO₅: C, 69.86; H, 6.37; N, 3.54. Found C, 69.69; H, 6.38; N, 4.59.

Reference Example 90

25 [0199] In a mixture of THF and ethanol (1 : 1, v/v, 30.0ml) was dissolved methyl 1-methylsulfonyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (354mg). To the solution was added 1N sodium hydroxide solution (7.7ml), and the mixture was stirred at room temperature for 15.5 hours. The mixture was a little concentrated, and to the residue was added 1N hydrochloric acid to convert weakly acidic solution. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give crystals, which were washed with ethyl acetate/

30 hexane to give 1-methylsulfonyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (337mg, 98%) as white crystals.

mp 213 - 215°C.

35 ¹H-NMR (200 MHz, DMSO-d₆) δ 0.88 (3H, t, J = 7.3 Hz), 1.54 (2H, sextet, J = 7.0 Hz), 2.50 (3H, s), 3.33 (2H, t-like), 3.43 (2H, t, J = 6.6 Hz), 3.72 (4H, t-like), 4.15 (2H, t-like), 7.04 (2H, d, J = 8.8 Hz), 7.51 (1H, d, J = 8.0 Hz), 7.63 - 7.75 (4H, m), 7.88 (1H, s).

IR (KBr) 1669, 1493, 1341, 1294, 1271, 1250, 1154, 1128, 785, 519 cm⁻¹.

40 Anal. Calcd. for C₂₃H₂₇NO₆S (0.1H₂O additive): C, 61.75; H, 6.13; N, 3.13. Found C, 61.50; H, 5.88; N, 3.01.

Reference Example 91

[0200] In THF (1000ml) was dissolved 4-[[N-(benzyloxy)carbonyl]amino]butyric acid (50.0g). To the solution were added propyl bromide (77.5g) and sodium iodide (94.4g), and to the mixture was gradually added at -5°C 60% sodium hydride (25.2g). Under nitrogen atmosphere, the mixture was stirred at 0°C for 15 minutes and then at 75°C for 4 days. The mixture was concentrated under reduced pressure, and to the residue was added water. The aqueous layer was adjusted to pH11 with sodium hydroxide (granule) and washed with ether (twice). The aqueous layer was adjusted to pH2 with concentrated hydrochloric acid and washed with ethyl acetate (thrice). The organic layer was washed with 1M sodium thiosulfate solution and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure to give 4-[[N-(benzyloxy)carbonyl]-N-propylamino]butyric acid (35.8g, 61%).

50 ¹H-NMR (200 MHz, CDCl₃) δ 0.88 (3H, t, J = 7.3 Hz), 1.50-1.57 (2H, m), 1.85 - 1.90 (2H, m), 2.34 - 2.41 (2H, m), 3.17 - 3.30 (4H, m), 5.13 (2H, s), 7.35 (5H, s).

Reference Example 92

55 [0201] To 4-[[N-(benzyloxy)carbonyl]-N-propylamino]butyric acid (35.8g) was added t-butanol (350ml), and then was added di-t-butyl dicarbonate (140g). To the mixture was added dimethylaminopyridine (4.69g), and the mixture was stirred at room temperature for 30 minutes. The mixture was concentrated under reduced pressure, and the residue

was purified with silica gel column chromatography to give pale yellow oil of t-butyl 4-[[N-(benzyloxy)carbonyl]-N-propylamino]butyrate (23.8g, 55%). ¹H-NMR (200 MHz, CDCl₃) δ 0.88 (3H, t, J = 7.3 Hz), 1.45 (9H, s), 1.52 - 1.59 (2H, m), 1.81 - 1.84 (2H, m), 2.23 (2H, t, J = 7.1 Hz), 3.17 - 3.27 (4H, m), 5.13 (2H, s), 7.35 (5H, s). IR (KBr) 2969, 1728, 1703, 1476, 1456, 1422, 1368, 1242, 1155, 1136 cm⁻¹.

Reference Example 93

[0202] In methanol (250ml) was dissolved t-butyl 4-[[N-(benzyloxy) carbonyl]-N-propylamino] butyrate (23.7g), and to the solution was added 10% palladium on carbon (2.37g). The mixture was stirred under hydrogen atmosphere at room temperature for 2 hours, and 10% palladium on carbon was removed. The solvent was evaporated under reduced pressure to give colorless oil of t-butyl 4-propylaminobutyrate [16.8g (containing methanol)]. ¹H-NMR (200 MHz, CDCl₃) δ 0.92 (3H, t, J = 7.1 Hz), 1.45 (9H, s), 1.47 - 1.67 (4H, m), 1.70 - 1.85 (2H, m), 2.25 (2H, q, J = 7.9 Hz), 2.60 (2H, dt, J = 11.6, 7.2 Hz), 3.21 (1H, m). IR (KBr) 2967, 2936, 1728, 1480, 1456, 1424, 1368, 1246, 1155 cm⁻¹.

Reference Example 94

[0203] To a solution of t-butyl 4-propylaminobutyrate (14.2g, 70.7mmol) in DMF (20ml) were added 5-bromo-2-fluorobenzaldehyde (14.4g, 70.9mmol) and potassium carbonate (14.7g, 106mmol) at room temperature, and the mixture was stirred at 80°C for 94 hours. The mixture was diluted with ethyl acetate, washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (hexane : ethyl acetate = 10 : 1) to give yellow oil of t-butyl 4-(4-bromo-2-formylphenyl)propylaminobutyrate (14.2g, 52%). ¹H-NMR (200 MHz, CDCl₃) δ 0.84 (3H, t, J = 7.8 Hz), 1.45 (9H, s), 1.42 - 1.63 (2H, m), 1.81 (2H, quint, J = 7.4 Hz), 2.19 (2H, t, J = 7.5 Hz), 3.09 (2H, t, J = 7.6 Hz), 3.17 (2H, t, J = 7.5 Hz), 7.06 (1H, d, J = 8.8 Hz), 7.56 (1H, dd, J = 8.7, 2.5 Hz), 7.90 (1H, d, J = 2.6 Hz), 10.24 (1H, s). IR (KBr) 2971, 1730, 1694, 1480, 1368, 1244, 1157 cm⁻¹.

Reference Example 95

[0204] In a mixture of t-butanol and toluene (1:10, v/v, 440ml) was dissolved t-butyl 4-(4-bromo-2-formylphenyl)propylbutyrate (14.1g). To the solution was added sodium t-butoxide (5.29g) at room temperature, and the mixture was heated to reflux for 1 hour (90°C), air-cooled, diluted with ethyl acetate, washed with water, 0.5N sodium hydroxide solution, water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (hexane : ethyl acetate = 4 : 1) to give yellow oil of t-butyl 7-bromo-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (8.07g, 60%). ¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.5 Hz), 1.53 (9H, s), 1.68 (2H, sextet, J = 7.6 Hz), 2.75 (2H, t, J = 4.4 Hz), 3.18 - 3.26 (4H, m), 6.67 (1H, d, J = 9.2 Hz), 7.22 (1H, dd, J = 8.8, 2.6 Hz), 7.39 (1H, d, J = 2.6 Hz), 7.46 (1H, s). IR (KBr) 2969, 1698, 1497, 1368, 1269, 1254, 1159 cm⁻¹.

Reference Example 96

[0205] In ethyl acetate (80ml) was dissolved t-butyl 7-bromo-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (8.05g). To the solution was added a solution of 4N hydrochloric acid in ethyl acetate (80ml), and the mixture was stirred at room temperature for 12 hours. To the mixture was added water, and the mixture was adjusted to pH2 with saturated sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue of solid was washed with hexane-ethyl acetate to give yellow crystals of 7-bromo-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (2.61g, 39%). mp 172 - 173°C. ¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.3 Hz), 1.70 (2H, sextet, J = 7.5 Hz), 2.81 (2H, t, J = 4.6 Hz), 3.22 - 3.29 (4H, m), 6.70 (1H, d, J = 8.8 Hz), 7.25 (1H, dd, J = 8.8, 2.6 Hz), 7.43 (1H, d, J = 2.0 Hz), 7.69 (1H, s). IR (KBr) 2963, 1674, 1497, 1410, 1277, 1171 cm⁻¹. Anal. Calcd. for C₂₄H₁₆BrNO₂: C, 54.21; H, 5.20; N, 4.52. Found C, 54.17; H, 5.05; N, 4.42.

Reference Example 97

[0206] In DMF (12ml) was dissolved 7-bromo-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (2430mg,

7.83mmol). To the solution was added thionyl chloride (1.4ml), and the mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure, and the residue was suspended in THF (50ml). To 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (2757mg) was added THF (40ml), and to the mixture was added dropwise triethylamine (8.2ml). The mixture was stirred at room temperature for 30 minutes, and to the mixture was added dropwise the previously prepared acid chloride suspension in THF, at 0°C. The mixture was stirred at room temperature for 21 hours, and the mixture was concentrated. To the mixture was added ethyl acetate, and the mixture was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (ethyl acetate → ethyl acetate:ethanol=10:1) and recrystallized from ethyl acetate-hexane to give yellow crystals of 7-bromo-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxamide (3219mg, 80%).

mp 134 - 136°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.97 (3H, t, J = 7.5 Hz), 1.60-1.80 (6H, m), 2.21 (3H, s), 2.57 - 2.70 (1H, m), 2.89 (2H, t, J = 4.6 Hz), 3.22 - 3.30 (4H, m), 3.37 (2H, td, J = 11.1, 2.8 Hz), 3.57 (2H, s), 4.01 - 4.07 (2H, m), 6.71 (1H, d, J = 9.2 Hz), 7.19 (1H, s), 7.24 (1H, dd, J = 9.0, 2.6 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.41 (1H, d, J = 2.6 Hz), 7.50 (1H, s), 7.52 (2H, d, J = 8.4 Hz).

IR (KBr) 2957, 1645, 1597, 1514, 1497, 1406, 1314, 1246, 1173 cm⁻¹.

Anal. Calcd. for C₂₇H₃₄BrN₃O₂: C, 63.28; H, 6.69; N, 8.20. Found C, 63.19; H, 6.54; N, 8.05.

Working Example 1 (Production of Compound 1)

[0207] In DMF (10ml) was dissolved 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.18g). To the solution was added, under ice-cooling, thionyl chloride (0.09ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (20ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.12g) and triethylamine (0.33ml) in THF (10ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-[4-(2-ethoxyethoxy)phenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxaldehyde (Compound 1) (0.23g) as colorless crystals. mp 192 - 194°C.

¹H-NMR (δ ppm, CDCl₃) 1.26 (3H, t, J = 7.0 Hz), 1.59 - 1.75 (4H, m), 2.21 (3H, s), 2.59 - 2.70 (1H, m), 3.02 (2H, t, J = 5.1 Hz), 3.37 (2H, dt, J = 1.5, 11.4 Hz), 3.57 (2H, s), 3.63 (2H, q, J = 7.0 Hz), 3.83 (2H, t, J = 4.8 Hz), 3.91 (2H, t, J = 5.1 Hz), 4.01 - 4.07 (2H, m), 4.18 (2H, t, J = 4.8 Hz), 7.02 (2H, d, J = 8.8 Hz), 7.18 (1H, d, J = 8.4 Hz), 7.31 (2H, d, J = 8.4 Hz), 7.45 - 7.57 (6H, m), 7.65 (1H, br), 7.66 (1H, d, J = 1.8 Hz), 8.54 (1H, s).

IR (KBr) ν: 3297, 2946, 2847, 1669 cm⁻¹.

Anal. Calcd. for C₃₅H₄₁N₃O₅: C, 72.02; H, 7.08; N, 7.20. Found C, 71.90; H, 6.79; N, 7.05.

Working Example 2 (Production of Compound 2)

[0208] In DMF (5ml) was dissolved 7-[4-(3-ethoxypropoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). To the solution was added, under ice-cooling, thionyl chloride (0.12ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was suspended in THF (15ml). The suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.16g) and triethylamine (0.44ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-[4-(3-ethoxypropoxy)phenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 2) (0.29g) as colorless crystals.

mp 166 - 169°C.

¹H-NMR (δ ppm, CDCl₃) 1.22 (3H, t, J = 7.0 Hz), 1.64 - 1.82 (4H, m), 2.02 - 2.15 (2H, m), 2.21 (3H, s), 2.60 - 2.68 (1H, m), 3.03 (2H, t, J = 5.5 Hz), 3.37 (2H, dt, J = 2.6, 11.2 Hz), 3.46 - 3.66 (6H, m), 3.92 (2H, t, J = 5.5 Hz), 4.02-4.07 (2H, m), 4.13 (2H, t, J = 6.3 Hz), 7.01 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.2 Hz), 7.32 (2H, d, J = 8.6 Hz), 7.47 - 7.60 (6H, m), 7.68 (1H, d, J = 2.0 Hz), 8.55 (1H, s). IR (KBr) ν: 2946, 2849, 1669 cm⁻¹.

Anal. Calcd. for C₃₆H₄₃N₃O₅: C, 72.34; H, 7.25; N, 7.03. Found C, 72.54; H, 7.11; N, 7.00.

Working Example 3 (Production of Compound 3)

[0209] In DMF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.23g). To the solution was added, under ice-cooling, thionyl chloride (0.11ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (25ml). The solution was added dropwise a solution of 4-[N-methyl-N-(tetrahydro-3H-pyran-4-yl)aminomethyl]aniline (0.15g), and triethylamine (0.4ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethanol to give 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-N-[4-[(N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino)methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 3) (0.23g) as colorless crystals.

mp 171 - 173°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.31 - 1.49 (2H, m), 1.55 - 1.65 (2H, m), 1.70 - 1.75 (4H, m), 2.21 (3H, s), 2.60 - 2.71 (1H, m), 3.04 (2H, t, J = 5.5 Hz), 3.37 (2H, dt, J = 3.2, 11.3 Hz), 3.53 - 3.59 (4H, m), 3.82 (2H, t, J = 4.9 Hz), 3.92 (2H, t, J = 5.5 Hz), 4.01 - 4.07 (2H, m), 4.18 (2H, t, J = 4.9 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.2 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.46 - 7.56 (6H, m), 7.68 (1H, d, J = 1.8 Hz), 8.55 (1H, s).

IR (KBr) ν: 2940, 1669, 1518, 1497 cm⁻¹.

Anal. Calcd. for C₃₇H₄₅N₃O₅: C, 72.64; H, 7.41; N, 6.87. Found C, 72.48; H, 7.11; N, 6.71.

Working Example 4 (Production of Compound 4)

[0210] In DMF (3.5ml) was dissolved 7-[4-[N-(2-ethoxyethyl)-N-methylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.17g). To the solution was added, under ice-cooling, thionyl chloride (0.08ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (25ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.11g) and triethylamine (0.31ml) in THF (6.5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature for 1 hour, poured into water and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column chromatography (ethyl acetate/ethanol) to give crude crystals, which were recrystallized from ethanol to give 7-[4-[N-(2-ethoxyethyl)-N-methylamino]phenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 4) (0.14g) as pale yellow crystals.

mp 157 - 158°C.

¹H-NMR (δ ppm, CDCl₃) 1.21 (3H, t, J = 7.4 Hz), 1.59 - 1.82 (4H, m), 2.20 (3H, s), 2.64 (1H, m), 2.96 - 3.06 (2H, m), 3.05 (3H, s), 3.30 - 3.43 (2H, m), 3.52 (2H, q, J = 7.0 Hz), 3.57 (2H, s), 3.56 - 3.63 (2H, m), 3.88 - 3.94 (2H, m), 3.99 - 4.07 (2H, m), 6.80 (2H, d, J = 8.8 Hz), 7.16 (1H, m), 7.29 - 7.56 (7H, m), 7.66 (1H, s), 8.53 (1H, s).

IR (KBr) ν: 2946, 2849, 1669, 1609, 1505, 1360, 1316, 1204, 1113, 814 cm⁻¹.

Working Example 5 (Production of Compound 5)

[0211] In DMF (5ml) was dissolved 7-[4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g). To the solution was added, under ice-cooling, thionyl chloride (0.09ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (25ml). The solution was added dropwise a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.20g) and triethylamine (0.35ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere stirred at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-[4-[N-(2-ethoxyethyl)-N-ethylamino]phenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 5) (0.23g) as pale yellow crystals.

mp 162 - 164°C.

¹H-NMR (δ ppm, CDCl₃) 1.17 - 1.30 (6H, m), 1.70 - 1.80 (4H, m), 2.21 (3H, s), 2.55 - 2.75 (1H, m), 3.03 (2H, t, J = 5.2 Hz), 3.33 - 3.62 (12H, m), 3.92 (2H, t, J = 5.2 Hz), 4.01-4.14 (2H, m), 6.78 (2H, d, J = 8.8 Hz), 7.16 (1H, d, J = 8.4 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.45 - 7.56 (6H, m), 7.66 (1H, d, J = 2.0 Hz), 8.54 (1H, s).

IR (KBr) ν: 2849, 1661, 1609, 1552, 1501 cm⁻¹.

EP 1 186 604 A1

Anal. Calcd. for $C_{37}H_{46}N_4O_4 \cdot 0.2H_2O$: C, 72.33; H, 7.61; N, 9.12. Found C, 72.30; H, 7.70; N, 9.23.

Working Example 6 (Production of Compound 6)

- 5 [0212] In DMF (7ml) was dissolved 7-[4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl]-1-formyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). To the solution was added, under ice-cooling, thionyl chloride (0.11ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (25ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.16g) and triethylamine (0.41ml) in THF (5ml), under ice-cooling, and the mixture
10 was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-[4-[N-ethyl-N-(2-propoxyethyl)amino]phenyl]-1-formyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 6) (0.27g) as pale yellow crystals.
15 mp 146 - 149°C.
1H-NMR (δ ppm, $CDCl_3$) 0.93 (3H, t, J = 7.3 Hz), 1.20 (3H, t, J = 6.9 Hz), 1.59 - 1.75 (6H, m), 2.21 (3H, s), 2.55 - 2.75 (1H, m), 3.03 (2H, t, J = 5.4 Hz), 3.31 - 3.61 (12H, m), 3.92 (2H, t, J = 5.4 Hz), 4.01 - 4.14 (2H, m), 6.78 (2H, d, J = 9.2 Hz), 7.16 (1H, d, J = 8.4 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.45 - 7.56 (6H, m), 7.66 (1H, d, J = 2.2 Hz), 8.54 (1H, s).
20 IR (KBr) v: 2942, 1669 cm^{-1} .
Anal. Calcd. for $C_{38}H_{48}N_4O_4 \cdot 0.3H_2O$: C, 72.42; H, 7.77; N, 8.89. Found C, 72.57; H, 7.53; N, 8.59.

Working Example 7 (Production of Compound 7)

- 25 [0213] In THF (15ml) was suspended 7-[4-(2-ethoxyethoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.14g). To the suspension were added, under ice-cooling, thionyl chloride (0.04ml) and DMF (catalytic amount), and the mixture was stirred at room temperature for 1.5 hours. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (15ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.08g) and triethylamine (0.14ml) in THF (15ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature for 1 hour. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give 7-[4-(2-ethoxyethoxy)phenyl]-1-methanesulfonyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 7) (0.15g) as
30 colorless amorphous.
1H-NMR (δ ppm, $CDCl_3$) 1.26 (3H, t, J = 7.0 Hz), 1.60 - 1.76 (4H, m), 2.22 (3H, s), 2.67 (1H, br), 2.89 (3H, s), 3.14 (2H, t, J = 5.2 Hz), 3.37 (2H, dt, J = 3.0, 11.0 Hz), 3.59 (2H, s), 3.63 (2H, q, J = 7.0 Hz), 3.83 (2H, t, J = 4.8 Hz), 3.92 (2H, t, J = 5.2 Hz), 4.01 - 4.07 (2H, m), 4.18 (2H, t, J = 4.6 Hz), 7.02 (2H, d, J = 8.8 Hz), 7.33 (2H, d, J = 8.8 Hz), 7.49 - 7.67 (8H, m).
35 IR (KBr) v: 2934, 2849, 1661, 1609, 1520, 1495 cm^{-1} .
Anal. Calcd. for $C_{33}H_{43}N_3O_6S$: C, 66.33; H, 6.84; N, 6.63. Found C, 66.39; H, 6.76; N, 6.57.

Working Example 8 (Production of Compound 8)

- 45 [0214] In THF (5ml) was dissolved 7-[4-(3-ethoxypropoxy)phenyl]-1-methanesulfonyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.20g). To the solution were added, under ice-cooling, thionyl chloride (0.06ml) and DMF (catalytic amount), and the mixture was stirred at room temperature for 2 hours. Under reduced pressure, the solvent was evaporated, and the residue was dissolved in THF (15ml). The solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.11g) and triethylamine (0.19ml) in THF (5ml), under ice-cooling, and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Under reduced pressure, the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate/hexane to give 7-[4-(3-ethoxypropoxy)phenyl]-1-methanesulfonyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 8) (0.22g) as colorless crystals.
50 mp 157 - 160°C.
1H-NMR (δ ppm, $CDCl_3$) 1.22 (3H, t, J = 7.0 Hz), 1.65 - 1.76 (4H, m), 2.06 - 2.15 (2H, m), 2.22 (3H, s), 2.55 - 2.78 (1H, m), 2.89 (3H, s), 3.14 (2H, t, J = 5.1 Hz), 3.38 (2H, dt, J = 2.6, 11.2 Hz), 3.46 - 3.65 (6H, m), 3.92 (2H, t, J = 5.1 Hz),
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3.95 - 4.15 (4H, m), 7.00 (2H, d, J = 9.2 Hz), 7.34 (2H, d, J = 8.4 Hz), 7.49 - 7.67 (9H, m).
IR (KBr) ν : 2926, 2851, 1671, 1595, 1524 cm^{-1} .

Working Example 9 (Production of Compound 9)

[0215] In a mixture of water:ethanol:toluene (1:1: 10, v/v, 18.0ml) were dissolved 4-(2-ethoxyethoxy)phenyl borate (315mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (485mg). To the solution was added potassium carbonate (332mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (46mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate : ethanol = 9 : 1) and recrystallized from ethanol to give 7-[4-(2-ethoxyethoxy)phenyl]-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 9) (230mg, 40%) as yellow crystals.

mp 122 - 125°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 1.26 (3H, t, J = 7.0 Hz), 1.23-1.76 (4H, m), 2.20 (3H, s), 2.53 - 2.71 (1H, m), 2.94 (2H, t, J = 4.4 Hz), 3.07 (3H, s), 3.32 (2H, t, J = 4.5 Hz), 3.37 (2H, td, J 11.4, 2.9 Hz), 3.56 (2H, s), 3.62 (2H, q, J = 7.0 Hz), 3.81 (2H, t, J = 4.9 Hz), 4.01 - 4.07 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.86 (1H, d, J = 8.6 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 9.0 Hz), 7.38 (1H, s), 7.43 (1H, dd, J = 8.6, 2.2 Hz), 7.47 (2H, d, J = 8.8 Hz), 1 H (d) was concealed under 7.49, 7.54 (2H, d, J = 8.6 Hz), 7.66 (1H, s).

IR (KBr) 2946, 2847, 1653, 1607, 1501, 1312, 1244, 1186, 1119, 814 cm^{-1} .

Anal. Calcd. for $\text{C}_{35}\text{H}_{43}\text{N}_3\text{O}_4$: C, 73.78; H, 7.61; N, 7.38. Found C, 73.93; H, 7.39; N, 7.44.

Working Example 10 (Production of Compound 10)

[0216] In DMF (5.0ml) was dissolved 1-methylsulfonyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (207mg). To the solution was added thionyl chloride (0.09ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (168mg) was added THF (5.0ml), and then was added triethylamine (0.50ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 4 hours. To the mixture was added ethyl acetate, and the mixture was washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (15g, ethyl acetate \rightarrow ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 1-methylsulfonyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 10) (176mg, 58%) as white crystals.

mp 174 - 177°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 1.64 - 1.77 (4H, m), 2.21 (3H, s), 2.24 (3H, s), 2.60 - 2.72 (1H, m), 2.89 (3H, s), 2.92 (2H, t, J = 6.9 Hz), 3.14 (2H, t, J = 5.3 Hz), 3.38 (2H, td, J = 11.4, 2.9 Hz), 3.58 (2H, s), 3.92 (2H, t, J = 5.3 Hz), 4.02 - 4.07 (2H, m), 4.22 (2H, t, J = 6.8 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.33 (2H, d, J = 8.4 Hz), 7.50 - 7.67 (9H, m).

IR (KBr) 1655, 1607, 1517, 1493, 1341, 1314, 1248, 1154 cm^{-1} .

Anal. Calcd. for $\text{C}_{34}\text{H}_{41}\text{N}_3\text{O}_5\text{S}_2$: C, 64.22; H, 6.50; N, 6.61. Found C, 64.03; H, 6.51; N, 6.55.

Working Example 11 (Production of Compound 11)

[0217] In DMF (10.0ml) was dissolved 1-formyl-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (484mg). To the solution was added thionyl chloride (0.23ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (10.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (444mg) was added THF (10.0ml), and then was added triethylamine (1.32ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 3 hours. To the mixture was added ethyl acetate and the mixture was washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate \rightarrow ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-methylthio)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound

11) (555mg, 75%) as white crystals.

mp 180 - 183°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.64 - 1.77 (4H, m), 2.21 (3H, s), 2.24 (3H, s), 2.59 - 2.67 (1H, m), 2.92 (2H, t, J = 6.8 Hz), 3.04 (2H, t, J = 4.6 Hz), 3.37 (2H, td, J = 11.2, 2.9 Hz), 3.57 (2H, s), 3.92 (2H, t, J = 5.3 Hz), 4.01 - 4.07 (2H, m),
 4.22 (2H, t, J = 6.8 Hz), 7.01 (2H, d, J = 8.8 Hz), 7.20 (1H, d, J = 8.0 Hz), 7.32 (2H, d, J = 8.8 Hz), 7.47 - 7.58 (7H, m),
 7.68 (1H, d, J = 1.8 Hz), 8.55 (1H, s).

IR (KBr) 1667, 1607, 1514, 1497, 1360, 1314, 1246, 824 cm⁻¹.

Anal. Calcd. for C₃₄H₃₉N₃O₄S (0.2H₂O additive): C, 69.29; H, 6.74; N, 7.13. Found C, 69.09; H, 6.58; N, 7.01.

10 Working Example 12 (Production of Compound 12)

[0218] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-propoxyethoxy)phenyl borate (242mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (436mg). To the solution was added potassium carbonate (299mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-triphenylphosphinepalladium (42mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate : ethanol : triethylamine = 180 : 20 : 1) and recrystallized from ethanol/hexane to give 1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 12) (186mg, 35%) as yellow crystals.
 mp 136 - 138°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.3 Hz), 1.65 (2H, sextet, J = 7.2 Hz), 1.69 - 1.76 (4H, m), 2.21 (3H, s), 2.57 - 2.72 (1H, m), 2.96 (2H, t, J = 4.4 Hz), 3.09 (3H, s), 3.32 - 3.43 (4H, m), 3.51 (2H, t, J = 6.8 Hz), 3.56 (2H, s),
 3.81 (2H, t, J = 5.0 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.88 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz),
 7.30 (2H, d, J = 8.6 Hz), 7.40 - 7.56 (8H, m).

IR (KBr) 1651, 1607, 1514, 1501, 1312, 1244, 1186 cm⁻¹.

Anal. Calcd. for C₃₆H₄₅N₃O₄ (0.3H₂O additive): C, 73.39; H, 7.80; N, 7.13. Found C, 73.12; H, 7.67; N, 7.08.

30 Working Example 13 (Production of Compound 13)

[0219] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(3-ethoxypropoxy)phenyl borate (250mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (450mg). To the solution was added potassium carbonate (308mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-triphenylphosphinepalladium (43mg), and the mixture was refluxed under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol/hexane to give 7-[4-(3-ethoxypropoxy)phenyl]-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 13) (359mg, 66%) as yellow crystals.
 mp 98 - 100°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.21 (3H, t, J = 6.9 Hz), 1.63-1.79 (4H, m), 2.07 (2H, quint, J = 6.3 Hz), 2.21 (3H, s), 2.54 - 2.75 (1H, m), 2.96 (2H, t, J = 4.4 Hz), 3.09 (3H, s), 3.31 - 3.43 (4H, m), 3.51 (2H, q, J = 7.0 Hz), 3.56 (2H, s), 3.62 (2H, t, J = 6.3 Hz), 4.00 - 4.07 (2H, m), 4.10 (2H, t, J = 6.2 Hz), 6.88 (1H, d, J = 8.6 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.6 Hz), 7.40 - 7.56 (3H, m), 7.40 (1H, s), 7.48 (2H, d, J = 9.0 Hz), 7.54 (2H, d, J = 8.6 Hz).

IR (KBr) 1647, 1607, 1514, 1501, 1312, 1244, 1182, 1115 cm⁻¹.

Anal. Calcd. for C₃₆H₄₅N₃O₄ (0.2H₂O additive): C, 73.62; H, 7.79; N, 7.15. Found C, 73.53; H, 7.63; N, 7.11.

50 Working Example 14 (Production of Compound 14)

[0220] In DMF (9.5ml) was dissolved 1-formyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (379mg). To the solution was added thionyl chloride (0.18ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (15.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (337mg) was added THF (10.0ml), and then was added triethylamine (1.00ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was stirred at room temperature for 15 hours. To the mixture was added ethyl acetate, and the mixture was washed with water and saturated brine.

The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (35g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 14) (459mg, 80%) as white crystals.

mp 187 - 189°C.
¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.4 Hz), 1.57-1.74 (6H, m), 2.20 (3H, s), 2.56 - 2.72 (1H, m), 3.03 (2H, t, J = 5.2 Hz), 3.37 (2H, td, J 11.0, 2.8 Hz), 3.52 (2H, t, J = 6.8 Hz), 3.57 (2H, s), 3.82 (2H, t, J = 4.9 Hz), 3.92 (2H, t, J = 5.3 Hz), 4.01 - 4.07 (2H, m), 4.18 (2H, t, J = 4.9 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.4 Hz), 7.31 (2H, d, J = 8.4 Hz), 7.46 - 7.58 (7H, m), 7.67 (1H, s), 8.55 (1H, s).
 IR (KBr) 1667, 1609, 1518, 1497, 1360, 1314, 1248, 824 cm⁻¹.
 Anal. Calcd. for C₃₆H₄₃N₃O₅: C, 72.34; H, 7.25; N, 7.03. Found C, 72.39; H, 7.32; N, 7.08.

Working Example 15 (Production of Compound 15)

[0221] In DMF (6.5ml) was dissolved 1-methylsulfonyl-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (296mg). To the solution was added thionyl chloride (0.12ml), and the mixture was stirred at room temperature for 30 minutes. Under reduced pressure, the solvent was evaporated, and to the residue was added THF (15.0ml). On the other hand, to 4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]aniline dihydrochloride (234mg) was added THF (10.0ml), and then was added triethylamine (0.69ml). To the obtained mixture was added dropwise at 0°C the previously prepared acid chloride suspension, and the mixture was washed with water and saturated brine. To the mixture was added ethyl acetate, and the mixture was washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate → ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 1-methylsulfonyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxy)ethoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 15) (248mg, 58%) as white crystals.

mp 161 - 162°C.
¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.3 Hz), 1.65 (2H, sextet, J = 7.1 Hz), 1.69 - 1.77 (4H, m), 2.21 (3H, s), 2.54 - 2.70 (1H, m), 2.88 (3H, s), 3.13 (2H, t, J = 5.0 Hz), 3.37 (2H, td, J = 11.4, 5.6 Hz), 3.52 (2H, t, J = 6.8 Hz), 3.57 (2H, s), 3.82 (2H, t, J = 4.8 Hz), 3.91 (2H, t, J = 5.7 Hz), 4.01 - 4.07 (2H, m), 4.18 (2H, t, J = 5.0 Hz), 7.00 - 7.04 (2H, m), 7.32 (2H, d, J = 8.4 Hz), 7.50 (2H, d, J = 8.8 Hz), 7.48 - 7.66 (7H, m).
 IR (KBr) 1663, 1609, 1516, 1493, 1343, 1310, 1248, 1154, 667 cm⁻¹.
 Anal. Calcd. for C₃₆H₄₅N₃O₆S: C, 66.74; H, 7.00; N, 6.49. Found C, 66.56; H, 7.03; N, 6.36.

Working Example 16 (Production of Compound 16)

[0222] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-ethoxyethoxy)phenylborate (339mg) and 7-bromo-1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (537mg). To the solution was added potassium carbonate (357mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenyl)phosphinepalladium (50mg), and the mixture was heated to reflux under argon atmosphere for 14 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (35g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : triethylamine = 100 : 10 : 0.5) and recrystallized from ethyl acetate/IPE to give 7-[4-(2-ethoxyethoxy)phenyl]-1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 16) (332mg, 53%) as yellow crystals. mp 114.5 - 116.5°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.26 (3H, t, J = 6.9 Hz), 1.32 (3H, t, J = 7.1 Hz), 1.63 - 1.76 (4H, m), 2.21 (3H, s), 2.59 - 2.69 (1H, m), 2.91 (2H, t, J = 4.8 Hz), 3.31 - 3.42 (4H, m), 3.44 (2H, q, J = 7.0 Hz), 3.57 (2H, s), 3.64 (2H, t, J = 6.9 Hz), 3.82 (2H, t, J = 4.8 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.91 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 9.2 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.40 (1H, s), 7.47 (2H, d, J = 9.2 Hz), 7.53 (2H, d, J = 8.4 Hz), 7.40 - 7.56 (3H, m).
 IR (KBr) 1651, 1607, 1514, 1501, 1312, 1244, 1175, 1140, 1119 cm⁻¹.
 Anal. Calcd. for C₃₆H₄₅N₃O₄ (0.2H₂O additive): C, 73.62; H, 7.79; N, 7.15. Found C, 73.45; H, 7.85; N, 7.05.

Working Example 17 (Production of Compound 17)

[0223] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-propoxyethoxy)phenyl

borate (272mg) and 7-bromo-1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (404mg). To the solution was added potassium carbonate (269mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (37mg), and the mixture was heated to reflux under argon atmosphere for 14 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethyl acetate/IPE to give 1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 17) (221mg, 46%) as yellow crystals. mp 106 - 108°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.5 Hz), 1.32 (3H, t, J = 6.9 Hz), 1.65 (2H, sextet, J = 7.1 Hz), 1.70 - 1.76 (4H, m), 2.21 (3H, s), 2.56 - 2.69 (1H, m), 2.92 (2H, t, J = 4.0 Hz), 3.31 - 3.46 (6H, m), 3.51 (2H, t, J = 6.8 Hz), 3.56 (2H, s), 3.81 (2H, t, J = 4.9 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.92 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.8 Hz), 7.40 (1H, s), 7.47 (2H, d, J = 8.8 Hz), 7.54 (2H, d, J = 8.8 Hz), 7.40 - 7.56 (3H, m).

IR (KBr) 2928, 1651, 1645, 1607, 1514, 1501, 1314, 1244, 1175 cm⁻¹.

Anal. Calcd. for C₃₇H₄₇N₃O₄ (0.3H₂O additive): C, 73.67; H, 7.95; N, 6.97. Found C, 73.52; H, 7.76; N, 6.95.

Working Example 18 (Production of Compound 18)

[0224] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-butoxyethoxy)phenyl borate (324mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (440mg). To the solution was added potassium carbonate (301mg) and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (42mg), and the mixture was refluxed under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethyl acetate/IPE to give 7-[4-(2-butoxyethoxy)phenyl]-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 18) (287mg, 53%) as yellow crystals.

mp 107 - 110°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.39 (2H, sextet, J = 7.3 Hz), 1.55 - 1.79 (6H, m), 2.21 (3H, s), 2.57 - 2.75 (1H, m), 2.96 (2H, t, J = 4.4 Hz), 3.09 (3H, s), 3.31 - 3.38 (2H, m), 3.37 (2H, td, J = 11.6, 2.7 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.81 (2H, t, J = 5.0 Hz), 4.00 - 4.08 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.88 (1H, d, J = 8.6 Hz), 6.96 - 7.01 (2H, m), 7.30 (2H, d, J = 8.4 Hz), 7.40 - 7.56 (4H, m), 7.48 (2H, d, J = 9.0 Hz), 7.54 (2H, d, J = 8.6 Hz).

IR (KBr) 2955, 2936, 1651, 1607, 1514, 1312, 1244, 1186 cm⁻¹.

Anal. Calcd. for C₃₇H₄₇N₃O₄ (0.1H₂O additive): C, 74.12; H, 7.93; N, 7.01. Found C, 73.90; H, 7.82; N, 7.12.

Working Example 19 (Production of Compound 19)

[0225] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-butoxyethoxy)phenyl borate (301mg) and 7-bromo-1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (420mg). To the solution was added potassium carbonate (279mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (39mg), and the mixture was refluxed under argon atmosphere for 14 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethyl acetate/IPE to give 7-[4-(2-butoxyethoxy)phenyl]-1-ethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 19) (218mg, 42%) as yellow crystals.

mp 102 - 106°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.1 Hz), 1.32 (3H, t, J = 7.0 Hz), 1.39 (2H, sextet, J = 7.4 Hz), 1.54 - 1.76 (6H, m), 2.21 (3H, s), 2.54 - 2.72 (1H, m), 2.92 (2H, t, J = 4.6 Hz), 3.31 - 3.50 (6H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.81 (2H, t, J = 4.9 Hz), 4.01 - 4.07 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.92 (1H, d, J = 8.6 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.40 (1H, s), 7.44 - 7.56 (3H, m), 7.47 (2H, d, J = 9.0 Hz), 7.54 (2H, d, J = 8.4 Hz).

IR (KBr) 2953, 2932, 1651, 1605, 1514, 1501, 1406, 1314, 1244, 1175 cm⁻¹.

Anal. Calcd. for C₃₉H₄₉N₃O₄ (0.2H₂O additive): C, 74.16; H, 8.09; N, 6.83. Found C, 73.92; H, 8.19; N, 6.59.

Working Example 20 (Production of Compound 20)

[0226] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-[(2-ethoxy)ethoxy]-3-fluorophenyl borate (355mg) and 7-bromo-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (517mg). To the solution was added potassium carbonate (344mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (48mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (30g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 1) and recrystallized from ethanol to give 7-[4-(2-ethoxy)ethoxy-3-fluorophenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 20) (476mg, 76%) as white crystals. mp 188 - 191°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.26 (3H, t, J = 7.1 Hz), 1.64-1.77 (4H, m), 2.20 (3H, s), 2.57 - 2.72 (1H, m), 3.04 (2H, t, J = 5.2 Hz), 3.37 (2H, td, J = 11.3, 2.9 Hz), 3.57 (2H, s), 3.63 (2H, q, J = 7.0 Hz), 3.85 (2H, t, J = 4.9 Hz), 3.92 (2H, t, J = 5.6 Hz), 4.01 - 4.07 (2H, m), 4.25 (2H, t, J = 4.9 Hz), 7.09 (1H, t, J = 8.6 Hz), 7.20 (1H, d, J = 8.2 Hz), 7.29 - 7.36 (2H, m), 7.32 (2H, d, J = 8.0 Hz), 7.45 (1H, s), 7.53 (2 H + 1H, d, J = 8.8 Hz), 7.56 (1H, s), 7.65 (1H, d, J = 2.2 Hz), 8.55 (1H, s).

IR (KBr) 1669, 1501, 1358, 1314, 1269, 1238, 1198, 1138, 1125 cm⁻¹.

Anal. Calcd. for C₃₅H₄₀FN₃O₄: C, 69.86; H, 6.70; N, 6.98. Found C, 69.66; H, 6.40; N, 6.71.

Working Example 21 (Production of Compound 21)

[0227] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 3-chloro-4-(2-ethoxy)ethoxyphenyl borate (280mg) and 7-bromo-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (380mg). To the solution was added potassium carbonate (253mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (35mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate → ethyl acetate : ethanol 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethanol to give 7-[3-chloro-4-(2-ethoxy)ethoxyphenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 21) (342mg, 73%) as white crystals. mp 198 - 200°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.26 (3H, t, J = 6.9 Hz), 1.64 - 1.76 (4H, m), 2.20 (3H, s), 2.57 - 2.69 (1H, m), 3.04 (2H, t, J = 5.2 Hz), 3.37 (2H, td, J = 11.1, 2.9 Hz), 3.57 (2H, s), 3.67 (2H, q, J = 7.0 Hz), 3.88 (2H, t, J = 5.0 Hz), 3.91 (2H, t, J = 6.0 Hz), 4.01 - 4.06 (2H, m), 4.24 (2H, t, J = 4.9 Hz), 7.05 (1H, d, J = 8.4 Hz), 7.20 (1H, d, J = 8.2 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.43 (1H, dd, J = 8.6, 2.4 Hz), 7.44 (1H, s), 7.54 (2 H + 1H, d, J = 8.4 Hz), 7.56 (1H, s), 7.61 (1H, d, J = 2.2 Hz), 7.65 (1H, d, J = 2.2 Hz), 8.55 (1H, s).

IR (KBr) 1669, 1599, 1516, 1493, 1360, 1314, 1292, 1260, 1140, 1065 cm⁻¹.

Anal. Calcd. for C₃₅H₄₀ClN₃O₅: C, 68.00; H, 6.52; N, 6.80. Found C, 67.71; H, 6.43; N, 6.71.

Working Example 22 (Production of Compound 22)

[0228] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(3-propoxy)propoxyphenyl borate (270mg) and 7-bromo-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (377mg). To the solution was added potassium carbonate (251mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (35mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate → ethyl acetate : ethanol = 10 : 1 → ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethanol to give 1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(3-propoxy)propoxyphenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 22) (304mg, 66%) as white crystals.

mp 174 - 177°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.92 (3H, t, J = 7.3 Hz), 1.60 (2H, sextet, J = 7.1 Hz), 1.69 - 1.76 (4H, m), 2.08 (2H, quint, J = 6.2 Hz), 2.20 (3H, s), 2.59 - 2.69 (1H, m), 3.03 (2H, t, J = 4.9 Hz), 3.31 - 3.41 (2H, m), 3.41 (2H, t, J = 6.6 Hz), 3.57

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(2H, s), 3.61 (2H, t, J = 6.0 Hz), 3.92 (2H, t, J = 5.3 Hz), 4.01 - 4.09 (2H, m), 4.12 (2H, t, J = 6.4 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.19 (1H, d, J = 8.0 Hz), 7.31 (2H, d, J = 8.4 Hz), 7.46 (1H, s), 7.51 (2H, d, J = 8.4 Hz), 7.54 (2H, d, J = 8.4 Hz), 7.49 - 7.58 (2H, m), 7.67 (1H, d, J = 1.8 Hz), 8.54 (1H, s).

IR (KBr) 2940, 1669, 1607, 1516, 1497, 1360, 1314, 1248, 1119 cm^{-1} .

5 Anal. Calcd. for $\text{C}_{37}\text{H}_{15}\text{N}_3\text{O}_5$: C, 72.64; H, 7.41; N, 6.87. Found C, 72.46; H, 7.62; N, 6.95.

Working Example 23 (Production of Compound 23)

10 [0229] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 3-ethoxy-4-(2-propoxy)ethoxyphenyl borate (324mg) and 7-bromo-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (401mg). To the solution was added potassium carbonate (267mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-
15 triphenylphosphinepalladium (37mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate \rightarrow ethyl acetate : ethanol = 10 : 1 \rightarrow ethyl acetate : ethanol : triethylamine = 100 : 10 : 0.5) and recrystallized from ethyl acetate/PE to give 7-[3-ethoxy-4-(2-propoxy)ethoxyphenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 23) (317mg, 61%) as white crystals.

20 mp 117 - 119°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 0.94 (3H, t, J = 7.3 Hz), 1.48 (3H, t, J = 6.9 Hz), 1.64 (2H, sextet, J = 7.2 Hz), 1.64 - 1.76 (4H, m), 2.20 (3H, s), 2.57 - 2.70 (1H, m), 3.03 (2H, t, J = 3.6 Hz), 3.37 (2H, td, J = 11.2, 2.7 Hz), 3.53 (2H, t, J = 6.7 Hz), 3.56 (2H, s), 3.84 (2H, t, J = 5.1 Hz), 3.92 (2H, t, J = 5.3 Hz), 4.01 - 4.07 (2H, m), 4.16 (2H, q, J = 7.1 Hz), 4.22 (2H, t, J = 5.2 Hz), 7.03 (1H, d, J = 8.8 Hz), 7.10 (1H, s), 7.11 (1H, dd, J = 8.4, 2.2 Hz), 7.18 (1H, d, J = 8.4 Hz), 7.32 (2H, d, J = 8.4 Hz), 7.50 (2H, d, J = 8.4 Hz), 7.54 (1H, d, J = 8.4 Hz), 7.57 (1H, d, J = 2.6 Hz), 7.60 (1H, s), 7.57 (1H, d, J = 1.8 Hz), 8.54 (1H, s).

25 IR (KBr) 2942, 1671, 1597, 1514, 1499, 1408, 1360, 1316, 1254, 1202, 1140 cm^{-1} .

Anal. Calcd. for $\text{C}_{38}\text{H}_{47}\text{N}_3\text{O}_6$ (0.1 H_2O additive): C, 70.92; H, 7.39; N, 6.53. Found C, 70.71; H, 7.36; N, 6.47.

30 Working Example 24 (Production of Compound 24)

[0230] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved (2,3-dihydro-1,4-benzodioxin-6-yl) borate (22mg) and 7-bromo-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (397mg). To the solution was added potassium carbonate (272mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-
35 triphenylphosphinepalladium (38mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (35g, ethyl acetate : ethanol = 20 : 1) and recrystallized from ethanol to give 7-(2,3-dihydro-1,4-benzodioxin-6-yl)-1-methyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 24) (215mg, 49%) as yellow crystals.

40 mp 164 - 165°C.

$^1\text{H-NMR}$ (200 MHz, CDCl_3) δ 1.63 - 1.76 (4H, m), 2.20 (3H, s), 2.53 - 2.73 (1H, m), 2.95 (2H, t, J = 4.4 Hz), 3.07 (3H, s), 3.31 - 3.43 (4H, m), 3.56 (2H, s), 4.01 - 4.07 (2H, m), 4.29 (4H, s), 6.86 (1H, d, J = 8.4 Hz), 6.90 (1H, d, J = 9.6 Hz), 7.05 (1H, dd, J = 10.4, 2.2 Hz), 7.07 (1H, s), 7.29 (2H, d, J = 8.6 Hz), 7.37 - 7.55 (3H, m), 7.54 (2H, d, J = 8.6 Hz), 7.62 (1H, s).

45 IR (KBr) 2948, 1644, 1597, 1514, 1497, 1406, 1312, 1283, 1246, 1188, 1071, 810, 733 cm^{-1} .

Anal. Calcd. for $\text{C}_{33}\text{H}_{37}\text{N}_3\text{O}_4$ (0.2 H_2O additive): C, 72.96; H, 6.94; N, 7.73. Found C, 72.86; H, 6.91; N, 7.70.

50 Working Example 25 (Production of Compound 25)

[0231] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-ethoxyethoxy)phenyl borate (246mg) and 7-bromo-1-propyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (400mg). To the solution was added potassium carbonate (259mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-
55 triphenylphosphinepalladium (36mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified

with silica gel column chromatography (30g, ethyl acetate → ethyl acetate : ethanol = 10 : 1) and recrystallized from ethyl acetate-IPE to give 7-[4-(2-ethoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 25) (216mg, 46%) as yellow crystals.
mp 144 - 147°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.99 (3H, t, J = 7.4 Hz), 1.26 (3H, t, J = 6.9 Hz), 1.63 - 1.84 (6H, m), 2.20 (3H, s); 2.56-2.69 (1H, m), 2.91 (2H, t, J = 4.4 Hz), 3.28 - 3.43 (6H, m), 3.56 (2H, s), 3.62 (2H, q, J = 7.0 Hz), 3.81 (2H, t, J = 4.9 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 4.8 Hz), 6.90 (1H, d, J = 8.6 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 8.4 Hz), 7.37 - 7.55 (8H, m).

IR (KBr) 2957, 2940, 1644, 1605, 1499, 1406, 1312, 1240, 1177, 1140, 1121 cm⁻¹.

Anal. Calcd. for C₃₇H₄₇N₃O₄: C, 74.34; H, 7.92; N, 7.02. Found C, 74.13; H, 7.76; N, 7.17.

Working Example 26 (Production of Compound 26)

[0232] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 18.0ml) were dissolved 4-(2-propoxyethoxy)phenyl borate (260mg) and 7-bromo-1-propyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (396mg). To the solution was added potassium carbonate (256mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-triphenylphosphinepalladium (36mg), and the mixture was heated to reflux under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (25g, ethyl acetate → ethyl acetate : ethanol = 10 : 1) and recrystallized from ethyl acetate-IPE to give N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 26) (252mg, 53%) as yellow crystals.
mp 128 - 130°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.5 Hz), 0.99 (3H, t, J = 7.6 Hz), 1.59 - 1.81 (8H, m), 2.20 (3H, s), 2.56 - 2.69 (1H, m), 2.92 (2H, t-like), 3.28 - 3.43 (6H, m), 3.51 (2H, t, J = 6.7 Hz), 3.56 (2H, s), 3.81 (2H, t, J = 5.0 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.90 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.4 Hz), 7.29 (2H, d, J = 8.8 Hz), 7.38 - 7.55 (8H, m).

IR (KBr) 2957, 2940, 1644, 1605, 1499, 1406, 1312, 1240, 1177, 1140, 1121 cm⁻¹.

Anal. Calcd. for C₃₈H₄₉N₃O₄: C, 74.60; H, 8.07; N, 6.87. Found C, 74.31; H, 8.21; N, 7.12.

Working Example 27 (Production of Compound 27)

[0233] In a mixture of water : ethanol : toluene (1 : 1 : 10, v/v, 24.0ml) were dissolved 4-(2-butoxyethoxy)phenyl borate (519mg) and 7-bromo-1-propyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (745mg). To the solution was added potassium carbonate (482mg), and the mixture was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis-triphenylphosphinepalladium (67mg), and the mixture was refluxed under argon atmosphere for 10 hours. The mixture was diluted with ethyl acetate, and washed with water and saturated brine, and the organic layer was dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure, and the residue was purified with silica gel column chromatography (35g, ethyl acetate → ethyl acetate : ethanol = 10 : 1) and recrystallized from ethyl acetate-IPE to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 27) (453mg, 50%) as yellow crystals.
mp 122 - 124°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.1 Hz), 0.99 (3H, t, J = 7.3 Hz), 1.39 (2H, sextet, J = 7.2 Hz), 1.54 - 1.80 (8H, m), 2.20 (3H, s), 2.53 - 2.71 (1H, m), 2.91 (2H, t, J = 4.0 Hz), 3.27 - 3.43 (6H, m), 3.52 - 3.58 (4H, m), 3.80 (2H, t, J = 5.0 Hz), 4.01 - 4.06 (2H, m), 4.15 (2H, t, J = 4.7 Hz), 6.89 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 8.4 Hz), 7.37 - 7.59 (8H, m).

IR (KBr) 2957, 2940, 1644, 1605, 1499, 1406, 1312, 1240, 1177, 1140, 1121 cm⁻¹.

Anal. Calcd. for C₃₉H₅₁N₃O₄: C, 74.85; H, 8.21; N, 6.71. Found C, 74.64; H, 8.36; N, 6.93.

Working Examples 28 (Production of Compound 28)

[0234] In 1N hydrochloric acid (50ml) and THF (50ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-formyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (1.4g). The solution was refluxed for 4.5 hours, concentrated, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-

4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 28) (1.0g) as yellow crystals. mp 119 - 123°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.34 - 1.75 (8H, m), 2.21 (3H, s), 2.60 - 2.65 (1H, m), 2.96 (2H, t-like), 3.32 - 3.58 (8H, m), 3.80 (2H, t, J = 5.0 Hz), 4.01 - 4.07 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 4.57 (1H, br), 6.70 (1H, d, J = 8.2 Hz), 6.98 (2H, d, J = 9.0 Hz), 7.26 - 7.32 (4H, m), 7.43 - 7.56 (5H, m).
IR (KBr) v: 3328, 2946, 2851, 1651, 1609, 1514, 1499 cm⁻¹. Anal. Calcd. for C₃₆H₄₅N₃O₄·0.25H₂O: C, 73.50; H, 7.80; N, 7.14. Found C, 73.54; H, 7.79; N, 7.15.

Working Example 29 (Production of Compound 29)

[0235] In DMF (5ml) was dissolved 1-propionyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1N-1-benzazepine-4-carboxylic acid (0.2g). Under ice-cooling, to the solution was added thionyl chloride (0.09ml). The mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure. In THF (15ml) was dissolved the residue, which was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.15g) and triethylamine (0.34ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere. The solvent was evaporated under reduced solvent. Water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 1-propionyl-7-[4-(2-propoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 29) (0.1g) as pale yellow crystals. mp 167 - 169°C.

¹H-NMR (δ ppm, CDCl₃) 0.95 (3H, t, J = 7.3 Hz), 1.08 (3H, t, J = 7.5 Hz), 1.58 - 1.75 (6H, m), 2.12 - 2.21 (1H, m), 2.21 (3H, s), 2.40 - 2.75 (2H, m), 2.75 - 3.00 (2H, m), 3.10 - 3.30 (1H, m), 3.37 (2H, dt, J = 2.8, 11.2 Hz), 3.52 (2H, t, J = 6.7 Hz), 3.58 (2H, s), 3.82 (2H, t, J = 4.8 Hz), 4.01 - 4.06 (2H, m), 4.19 (2H, t, J = 4.8 Hz), 4.81 - 4.88 (1H, m), 7.03 (2H, d, J = 8.8 Hz), 7.24 - 7.34 (3H, m), 7.50 - 7.56 (6H, m), 7.67 (1H, s).
IR (KBr) v: 2944, 1653 cm⁻¹.
Anal. Calcd. for C₃₉H₄₇N₃O₅·0.5H₂O: C, 71.90; H, 7.62; N, 6.62. Found C, 71.84; H, 7.48; N, 6.71.

Working Example 30 (Production of Compound 30)

[0236] In DMF (6ml) was dissolved 1-butyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.30g). Under ice-cooling, to the mixture was added thionyl chloride (0.15ml). The mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure. In THF (20ml) was suspended the residue, and the suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.17g) and triethylamine (0.42ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere. The solvent was evaporated under reduced solvent. Water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/ triethylamine). The material was dissolved in ethyl acetate-ethanol, and 6N hydrochloric acid was added to the solution. The solvent was evaporated. Diethyl ether was added to the residue, and the precipitates were filtered to give 1-butyl-7-[4-(2-propoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1N-1-benzazepine-4-carboxamide dihydrochloride (Compound 30) (0.36g) as pale yellow amorphous.

¹H-NMR (δ ppm, DMSO-d₆) 0.84 - 1.02 (6H, m), 1.30 - 1.45 (2H, m), 1.49 - 1.70 (4H, m), 1.70 - 1.95 (2H, m), 1.95 - 2.20 (2H, m), 2.58 (3H, d, J = 5.0 Hz), 2.80 - 2.85 (2H, m), 3.20 - 3.46 (8H, m), 3.66 - 3.84 (3H, m), 3.96 - 4.14 (3H, m), 4.12 (2H, t, J = 4.7 Hz), 4.39 - 4.45 (1H, m), 6.93 - 7.02 (3H, m), 7.41 - 7.63 (7H, m), 7.81 (2H, d, J = 8.4 Hz), 10.00 (1H, s), 10.22 (1H, br).
IR (KBr) v: 2691, 2930, 2872, 1653, 1609, 1518, 1501 cm⁻¹. Anal. Calcd. for C₃₉H₅₁N₃O₄·2HCl·H₂O: C, 65.35; H, 7.73; N, 5.86. Found C, 65.04; H, 7.88; N, 5.66.

Working Example 31 (Production of Compound 31)

[0237] A mixture of 7-bromo-1-cyclopropyl-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.45g), 4-(2-butoxyethoxy)phenyl borate (0.23g), 1M potassium carbonate solution (1.5ml), ethanol (1.5ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.05g) and the mixture was refluxed for 3 hours under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and

saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 31) (0.25g) as pale yellow crystals.

mp 117 - 120°C.

¹H-NMR (δ ppm, CDCl₃) 0.55 - 0.62 (2H, m), 0.85 - 0.93 (2H, m), 0.93 (3H, t, J = 7.0 Hz), 1.21 - 1.76 (8H, m), 2.20 (3H, s), 2.56 - 2.76 (2H, m), 2.90 (2H, t-like), 3.34 (2H, dt, J = 8.0, 11.4 Hz), 3.43 - 3.59 (6H, m), 3.80 (2H, t, J = 5.0 Hz), 4.00 - 4.06 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.25 - 7.36 (3H, m), 7.42 - 7.54 (7H, m).

Anal. Calcd. for C₃₉H₄₉N₃O₄: C, 75.09; H, 7.92; N, 6.74. Found C, 75.09; H, 8.14; N, 6.78.

Working Example 32 (Production of Compound 32)

[0238] In DMF (4ml) was dissolved 1-benzyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.15g). Under ice-cooling, to the mixture was added thionyl chloride (0.06ml). The mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.09g) and triethylamine (0.23ml) in THF (10ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere. The solvent was evaporated under reduced solvent. Water was added to the mixture, the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine). The material was dissolved in ethyl acetate, and 4N hydrochloric acid-ethyl acetate was added to the solution. The solvent was evaporated to give 1-benzyl-7-[9-(2-propoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide hydrochloride (Compound 32) (0.14g) as yellow amorphous.

¹H-NMR (δ ppm, DMSO-d₆) 0.87 (3H, t, J = 7.3 Hz), 1.48 - 1.59 (2H, m), 1.65 - 2.15 (4H, m), 2.57 (3H, d, J = 4.8 Hz), 2.81 (2H, s), 3.25 - 3.45 (7H, m), 3.98 - 4.13 (5H, m), 4.39 - 4.46 (1H, m), 4.66 (2H, s), 6.86 (1H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.27 - 7.57 (11H, m), 7.67 (1H, s), 7.81 (2H, d, J = 8.4 Hz), 10.04 (1H, s), 10.44 (1H, br). IR (KBr) ν: 2963, 2868, 1655, 1607, 1518, 1499 cm⁻¹.

Anal. Calcd. for C₄₂H₄₉N₃O₄·HCl·1.5H₂O: C, 69.74; H, 7.39; N, 5.81. Found C, 69.35; H, 7.40; N, 5.84.

Working Example 33 (Production of Compound 33)

[0239] In THF (5ml) was dissolved 1-benzyl-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.3g). Under ice-cooling, to the solution were added oxalyl (0.11ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 30 minutes, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.15g) and triethylamine (0.44ml) in THF (10 ml), under ice-cooling. The mixture was stirred at room temperature under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified by silica gel column chromatography (ethyl acetate/methanol/ triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 1-benzyl-7-[4-(2-butoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 33) (0.26g) as pale yellow crystals.

mp 127 - 131°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.1 Hz), 1.30 - 1.75 (8H, m), 2.21 (3H, s), 2.55 - 2.70 (1H, m), 2.85 (2H, t-like), 3.31 - 3.38 (4H, m), 3.52 - 3.58 (4H, m), 3.80 (2H, t, J = 4.9 Hz), 4.01 - 4.05 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 4.61 (2H, s), 6.90 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.56 (14H, m).

IR (KBr) ν: 2934, 2851, 1651, 1601, 1514, 1501 cm⁻¹.

Anal. Calcd. for C₄₃H₅₁N₃O₄·0.25H₂O: C, 76.13; H, 7.65; N, 6.19. Found C, 76.19; H, 7.55; N, 6.19.

Working Example 34 (Production of Compound 34)

[0240] In THF (3ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-cyclohexylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). Under ice-cooling, to the solution were added oxalyl chloride (0.09ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-

5 methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.14g) and triethylamine (0.36ml) in THF (5 ml), under ice-cooling. The mixture was stirred at room temperature under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated to give crude crystals, which were recrystallized from diethyl ether-ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclohexylmethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 34) (0.28g) as pale yellow crystals.

mp 115 - 117°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 0.93 - 1.84 (19H, m), 2.21 (3H, s), 2.58 - 2.66 (1H, m), 2.91 (2H, t-like), 3.22 (2H, d, J = 6.6 Hz), 3.30 - 3.46 (4H, m), 3.50 - 3.58 (4H, m), 3.80 (2H, t, J = 4.9 Hz), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.91 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.37-7.56 (7H, m). IR (KBr) ν: 2924, 2849, 1651, 1605, 1516, 1499 cm⁻¹. Anal. Calcd. for C₄₃H₅₇N₃O₄: C, 75.96; H, 8.45; N, 6.18. Found C, 75.93; H, 8.58; N, 6.21.

15 Working Example 35 (Production of Compound 35)

[0241] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.35g). Under ice-cooling, to the solution were added oxalyl chloride (0.14ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.20g) and triethylamine (0.56ml) in THF (10 ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropylmethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 35) (0.36g) as yellow crystals.

mp 92 - 94°C.

¹H-NMR (δ ppm, CDCl₃) 0.26 - 0.33 (2H, m), 0.60 - 0.69 (2H, m), 0.93 (3H, t, J = 7.4 Hz), 1.05 - 1.18 (1H, m), 1.22 - 2.05 (8H, m), 2.21 (3H, s), 2.59 - 2.67 (1H, m), 2.95 (2H, t-like), 3.25 (2H, d, J = 6.2 Hz), 3.32 - 3.58 (8H, m), 3.80 (2H, t, J = 5.0 Hz), 3.93 - 4.18 (4H, m), 6.95 - 7.00 (3H, m), 7.29 (2H, d, J = 8.8 Hz), 7.41 - 7.58 (7H, m).

[0242] IR (KBr) ν: 3289, 2940, 2870, 1651, 1607, 1516, 1499 cm⁻¹. Anal. Calcd. for C₄₃H₅₁N₃O₄: C, 75.32; H, 8.06; N, 6.59.

35 [0243] Found C, 75.21; H, 8.12; N, 6.49.

Working Example 36 (Production of Compound 36)

[0244] In THF (5ml) was dissolved 1-cyclopropylmethyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). Under ice-cooling, to the solution were added oxalyl chloride (0.11ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.14g) and triethylamine (0.41ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine), which was dissolved in ethyl acetate. To the solution was added 4N hydrochloric acid-ethyl acetate, and the solvent was evaporated to give 1-cyclopropylmethyl-7-[4-(2-propoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide dihydrochloride (Compound 36) (0.32g) as pale yellow amorphous.

¹H-NMR (δ ppm, DMSO-d₆) 0.29 - 0.31 (2H, m), 0.54 - 0.57 (2H, m), 0.88 (2H, t, J = 7.5 Hz), 1.06 - 1.13 (1H, m), 1.45 - 1.63 (2H, m), 1.70 - 2.20 (4H, m), 2.57 (3H, d, J = 4.8 Hz), 2.89 (2H, br), 3.25 - 3.46 (9H, m), 3.69 - 3.74 (2H, m), 4.10 - 4.14 (5H, m), 4.37 - 4.45 (1H, m), 7.00 (2H, d, J = 8.8 Hz), 7.03 - 7.11 (1H, m), 7.44 - 7.59 (6H, m), 7.68 (1H, s), 7.81 (2H, d, J = 8.6 Hz), 10.07 (1H, s), 10.63 (1H, br).

Working Example 37 (Production of Compound 37)

[0245] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-cyclobutylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). Under ice-cooling, to the solution were added oxalyl chloride (0.1ml) and

[0246] DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.13g) and triethylamine (0.4ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate.

The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine), which was dissolved in ethyl acetate. To the solution was added 4N hydrochloric acid-ethyl acetate, and the solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclobutylmethyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1N-1-benzazepine-4-carboxamide dihydrochloride (Compound 37)

(0.27g) as pale yellow amorphous.
¹H-NMR (δ ppm, DMSO-d₆) 0.89 (3H, t, J = 7.1 Hz), 1.24 - 1.58 (4H, m), 1.73 - 2.15 (1H, m), 2.57 (3H, d, J = 4.8 Hz), 2.60 - 2.85 (3H, m), 3.20 - 3.49 (10H, m), 3.96 - 4.13 (5H, m), 4.38 - 4.44 (1H, m), 6.97 - 7.02 (3H, m), 7.40 - 7.63 (7H, m), 7.80 (2H, d, J = 8.8 Hz), 10.02 (1H, s), 10.41 (1H, s).
 Anal. Calcd. for C₄₁H₅₃N₃O₄·2HCl·1.5H₂O: C, 65.50; H, 7.78; N, 5.59. Found C, 65.51; H, 7.77; N, 5.24.

Working Example 38 (Production of Compound 38)

[0247] In DMF (6ml) was dissolved 1-phenyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g). Under ice-cooling, to the mixture was added thionyl chloride (0.08ml). The mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure. In THF (20ml) was suspended the residue, the suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.12g) and triethylamine (0.31ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere. The solvent was evaporated under reduced pressure. Water was added to the mixture, the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated, the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine), which was dissolved in ethyl acetate-ethanol, 4N hydrochloric acid-ethyl acetate was added to the solution, and the solvent was evaporated to give 1-phenyl-7-[4-(2-propoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide hydrochloride (Compound 38) (0.17g) as yellow crystals.

mp 223 - 224°C.
¹H-NMR (δ ppm, DMSO-d₆) 0.88 (3H, t, J = 7.3 Hz), 1.45-1.60 (2H, m), 1.70 - 1.95 (2H, m), 1.95 - 2.15 (2H, m), 2.58 (3H, d, J = 4.8 Hz), 2.84 (2H, br), 3.22 - 3.46 (4H, m), 3.72 (2H, t, J = 4.7 Hz), 3.75 - 4.12 (5H, m), 4.15 (2H, t, J = 4.7 Hz), 4.39 - 4.46 (1H, m), 6.80 - 6.90 (1H, m), 6.98 - 7.07 (4H, m), 7.20 - 7.30 (3H, m), 7.47 - 7.57 (4H, m), 7.65 (2H, d, J = 8.8 Hz), 7.79 (2H, d, J = 8.8 Hz), 7.85 (1H, s), 9.96 (1H, br), 10.07 (1H, s).
 IR (KBr) ν: 2961, 2928, 2863, 1651, 1520, 1495 cm⁻¹.
 Anal. Calcd. for C₄₁H₄₇N₃O₄·HCl·0.5H₂O: C, 71.23; H, 7.14; N, 6.08. Found C, 71.56; H, 7.17; N, 6.18.

Working Example 39 (Production of Compound 39)

[0248] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). Under ice-cooling, to the solution were added oxalyl chloride (0.1ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was suspended the residue, the suspension was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.13g) and triethylamine (0.38ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give 7-[4-(2-butoxyethoxy)phenyl]-1-phenyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 39) (0.21g) as yellow amorphous.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.27 - 1.49 (2H, m), 1.55 - 1.74 (6H, m), 2.19 (3H, s), 2.58 - 2.66 (1H, m), 2.93 (2H, t, J = 4.8 Hz), 3.36 (2H, dt, J = 3.2, 10.8 Hz), 3.52 - 3.59 (4H, m), 3.81 (2H, t, J = 5.0 Hz), 3.89 (2H, t, J = 4.8 Hz), 4.00 - 4.06 (2H, m), 4.17 (2H, t, J = 5.0 Hz), 6.88 - 7.02 (5H, m), 7.21 - 7.30 (4H, m), 7.41 (1H, dd, J =

2.2, 8.6 Hz), 7.48 - 7.53 (6H, m), 7.64 (1H, d, J = 2.2 Hz).

IR (KBr) ν : 2953, 2934, 2847, 1653, 1595, 1520, 1495 cm^{-1} . Anal. Calcd. for $\text{C}_{42}\text{H}_{49}\text{N}_3\text{O}_4 \cdot 0.25\text{H}_2\text{O}$: C, 75.93; H, 7.51; N, 6.32. Found C, 75.80; H, 7.40; N, 6.30.

5 Working Example 40 (Production of Compound 40)

[0249] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.15g). Under ice-cooling, to the solution were added oxalyl chloride (0.06ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 30 minutes, and the solvent was evaporated under reduced pressure. In THF (30ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.07g) and triethylamine (0.2ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 40) (0.11g) as pale yellow crystals.

mp 94 - 97°C.

¹H-NMR (δ ppm, CDCl_3) 0.93 (3H, t, J = 7.4 Hz), 1.27 - 1.76 (8H, m), 2.20 (3H, s), 2.58 - 2.69 (1H, m), 2.95 (2H, t-like), 3.36 (2H, dt, J = 3.4, 11.5 Hz), 3.52 - 3.59 (4H, m), 3.76 (3H, s), 3.76 - 3.87 (4H, m), 4.00 - 4.06 (2H, m), 4.17 (2H, t, J = 4.9 Hz), 6.43 - 6.62 (3H, m), 7.00 (2H, d, J = 8.8 Hz), 7.14 - 7.30 (3H, m), 7.40 - 7.54 (7H, m), 7.64 (1H, d, J = 1.8 Hz).

IR (KBr) ν : 2955, 2845, 1661, 1595, 1516, 1493 cm^{-1} .

25 Anal. Calcd. for $\text{C}_{43}\text{H}_{51}\text{N}_3\text{O}_5$: C, 74.86; H, 7.45; N, 6.09. Found C, 74.52; H, 7.66; N, 6.19.

Working Example 41 (Production of Compound 41)

[0250] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(4-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g). Under ice-cooling, to the solution were added oxalyl chloride (0.08ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (20ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.1g) and triethylamine (0.3ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(4-methoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 41) (0.22g) as yellow amorphous.

¹H-NMR (δ ppm, CDCl_3) 0.93 (3H, t, J = 7.1 Hz), 1.26 - 1.48 (2H, m), 1.54 - 1.74 (6H, m), 2.20 (3H, s), 2.58 - 2.66 (1H, m), 2.90 (2H, t-like), 3.37 (2H, dt, J = 2.2, 12.7 Hz), 3.52 - 3.58 (4H, m), 3.78 - 3.83 (7H, m), 4.01 - 4.06 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.85 - 7.05 (7H, m), 7.26 - 7.34 (2H, m), 7.46 - 7.59 (7H, m).

Working Example 42 (Production of Compound 42)

[0251] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g). Under ice-cooling, to the solution were added oxalyl chloride (0.05ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (20ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.11g) and triethylamine (0.3ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(4-propoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 42) (0.2g) as yellow amorphous.

¹H-NMR (δ ppm, CDCl_3) 0.93 (3H, t, J = 7.3 Hz), 1.04 (3H, t, J = 7.3 Hz), 1.34 - 1.48 (2H, m), 1.54 - 1.86 (8H, m), 2.20 (3H, s), 2.58 - 2.69 (1H, m), 2.88 (2H, t-like), 3.36 (2H, dt, J = 3.4, 11.0 Hz), 3.52 - 3.58 (5H, m), 3.78 - 3.83 (4H, m),

3.90 (2H, t, J = 10.1 Hz), 4.00 - 4.17 (4H, m), 6.84 - 7.03 (7H, m), 7.26 - 7.33 (2H, m), 7.45 - 7.61 (7H, m).
IR (KBr) v: 2936, 2872, 1651, 1607, 1495 cm⁻¹.

Working Example 43 (Production of Compound 43)

[0252] In THF (5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(3,4-methylenedioxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.25g). Under ice-cooling, to the solution were added oxalyl chloride (0.1ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (30ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.13g) and triethylamine (0.35ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3,4-methylenedioxyphenyl)-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 43) (0.28g) as yellow amorphous.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.22 - 1.48 (4H, m), 1.54 - 1.74 (4H, m), 2.20 (3H, s), 2.58 - 2.67 (1H, m), 2.91 (2H, t-like), 3.37 (2H, dt, J = 3.0, 11.2 Hz), 3.52 - 3.59 (4H, m), 3.78 - 3.83 (4H, m), 4.01 - 4.19 (4H, m), 5.95 (2H, s), 6.50 (1H, dd, J = 2.2, 8.4 Hz), 6.61 (1H, d, J = 2.2 Hz), 6.76 (1H, d, J = 8.4 Hz), 6.97 - 7.03 (3H, m), 7.26 - 7.37 (3H, m), 7.46 - 7.59 (7H, m).
IR (KBr) v: 2951, 2872, 1651, 1607, 1514, 1487 cm⁻¹.

Working Example 44 (Production of Compound 17)

[0253] In phosphorus oxychloride (25ml) was dissolved 1-(N-acetylglucyl)-7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.5g). The solution was heated to stir at room temperature for 7 hours and at 50°C for 2 hours, and the solvent was evaporated. To the residue was added sodium hydrogen carbonate solution, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with basic silica gel column chromatography (ethyl acetate/hexane). The resulting crude crystals were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyloxazol-5-yl)-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 44) (0.26g) as pale yellow crystals. mp 125 - 128°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.22 - 1.48 (2H, m), 1.54 - 1.76 (6H, m), 2.20 (3H, s), 2.41 (3H, s), 2.55 - 2.70 (1H m), 2.96 (2H, t-like), 3.36 (2H, dt, J = 2.6, 11.0 Hz), 3.52 - 3.58 (4H, m), 3.72 (2H, t-like), 3.80 (2H, t, J = 4.8 Hz), 4.00 - 4.06 (2H, m), 4.15 (2H, t, J = 4.8 Hz), 6.33 (1H, s), 6.98 (2H, d, J = 8.8 Hz), 7.08 (1H, d, J = 8.4 Hz), 7.26 - 7.56 (8H, m), 7.76 (1H, s).
IR (KBr) v: 2936, 2870, 1651, 1516, 1495 cm⁻¹.
Anal. Calcd. for C₄₀H₄₈N₄O₅: C, 72.26; H, 7.28; N, 8.43. Found C, 72.16; H, 7.10; N, 8.51.

Working Example 45 (Production of Compound 45)

[0254] In DMF (20ml) were suspended 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methylthiazol-4-yl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.13g), 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline dihydrochloride (0.1g) and 1-hydroxybenzotriazole (0.06g). Under ice-cooling, to the suspension were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.15g), triethylamine (0.18ml) and 4-dimethylaminopyridine (catalytic amount), and the mixture was stirred at room temperature overnight, which was poured into water and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-diethyl ether-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methylthiazol-4-yl)-N-[4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 45) (0.087g) as pale yellow crystals.
mp 115 - 123°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.30 - 1.45 (2H, m), 1.55 - 1.76 (6H, m), 2.21 (3H, s), 2.55 - 2.75 (1H, m), 2.67 (3H, s), 2.94 (2H, t-like), 3.36 (2H, dt, J = 2.6, 11.2 Hz), 3.52 - 3.59 (4H, m), 3.81 (2H, t, J = 4.9 Hz), 4.01 - 4.19 (6H, m), 5.93 (1H, s), 7.00 (2H, d, J = 8.8 Hz), 7.31 (1H, s), 7.43 - 7.60 (9H, m).
IR (KBr) v: 2932, 2870, 2843, 1659, 1597, 1526, 1518, 1495 cm⁻¹.

Working Example 46 (Production of Compound 46)

[0255] In DMF (20ml) were suspended 7-[4-(2-butoxyethoxy)phenyl]-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.15g), 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline dihydrochloride (0.11g) and 1-hydroxybenzotriazole (0.06g). Under ice-cooling, to the suspension were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.16g), triethylamine (0.2ml) and 4-dimethylaminopyridine (catalytic amount), and the mixture was stirred at room temperature overnight. The solvent was evaporated, water was added to the residue, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 46) (0.085g) as yellow crystals. mp 108 - 111°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.48 (2H, m), 1.54 - 1.75 (6H, m), 2.15 (3H, s), 2.57 - 2.67 (1H, m), 2.78 - 2.94 (2H, m), 3.33 (2H, t, J = 10.3 Hz), 3.46 - 3.58 (4H, m), 3.78 - 3.82 (4H, m), 3.97 - 4.02 (2H, m), 4.06 - 4.14 (2H, m), 6.78 (2H, d, J = 9.2 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.19 - 7.29 (3H, m), 7.36 - 7.63 (9H, m), 8.16 (1H, s).

Working Example 47 (Production of Compound 47)

[0256] In DMF (25ml) were suspended 7-[4-(2-butoxyethoxy)phenyl]-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.3g), 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline dihydrochloride (0.19g) and 1-hydroxybenzotriazole (0.07g). Under ice-cooling, to the suspension were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.15g), triethylamine (0.37ml) and 4-dimethylaminopyridine (catalytic amount), and the mixture was stirred at room temperature overnight. The solvent was evaporated, water was added to the residue, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate, and the solvent was evaporated. The residue was purified with silica gel column (ethyl acetate/methanol/triethylamine) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(N,N-dimethyl-4-sulfamoylphenyl)-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 47) (0.12g) as colorless crystals.

mp 94 - 98°C.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.1 Hz), 1.22 - 1.74 (8H, m), 2.20 (3H, s), 2.55 - 2.70 (1H, m), 2.70 (6H, s), 3.02 (2H, t-like), 3.36 (2H, dt, J = 2.6, 11.0 Hz), 3.53 - 3.60 (4H, m), 3.82 (2H, t, J = 5.0 Hz), 3.85 - 4.14 (4H, m), 4.18 (2H, t, J = 5.0 Hz), 6.96 (2H, d, J = 8.8 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.37 - 7.63 (9H, m), 7.70 (1H, d, J = 2.2 Hz).

Working Example 48 (Production of Compound 48)

[0257] In THF (7ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.4g). Under ice-cooling, to the solution were added oxalyl chloride (0.19ml) and DMF (catalytic amount). The mixture was stirred at room temperature for 1 hour, and the solvent was evaporated under reduced pressure. In THF (25ml) was dissolved the residue, and the solution was added dropwise to a suspension of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline dihydrochloride (0.28g) and triethylamine (0.5ml) in THF (5ml), under ice-cooling. The mixture was stirred at room temperature under nitrogen atmosphere for 1 hour and the solvent was evaporated under reduced pressure. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with basic silica gel column chromatography (ethyl acetate) to give crude crystals, which were recrystallized from ethyl acetate-hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(N-methyl-4-sulfamoylphenyl)-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 48) (0.28g) as pale yellow crystals. mp 96 - 99°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.29 - 1.71 (8H, m), 2.17 (3H, s), 2.59 (3H, d, J = 4.0 Hz), 2.60 - 2.70 (1H, m), 2.95 (2H, t-like), 3.35 (2H, dt, J = 2.6, 11.4 Hz), 3.52 - 3.59 (4H, m), 3.79 - 3.88 (4H, m), 3.99 - 4.17 (4H, m), 4.66 (1H, br), 6.86 (2H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.4 Hz), 7.23 - 7.66 (12H, m), 8.05 (1H, d, J = 9.6 Hz).
IR (KBr) ν: 2942, 2853, 1661, 1590, 1495 cm⁻¹.

Reference Example 98

[0258] Propionyl chloride (1.0ml) was added dropwise to a suspension of methyl 7-(2-propoxyethoxy)-2,3-dihydro-

1H-1-benzazepine-4-carboxylate (0.2g) and potassium carbonate (2.2g) in DMF (10ml) under ice-cooling. The mixture was stirred at room temperature overnight under nitrogen atmosphere, and poured into water, which was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-propionyl-7-(2-propoxyethoxy)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g) as pale yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.95 (3H, t, J = 7.3 Hz), 1.05 (3H, t, J = 7.3 Hz), 1.57 - 1.75 (2H, m), 2.09 - 2.20 (1H, m), 2.41 - 2.53 (1H, m), 2.75 - 2.84 (2H, m), 2.88 - 3.10 (1H, m), 3.52 (2H, t, J = 6.7 Hz), 3.80 - 3.83 (5H, m), 4.18 (2H, t, J = 4.6 Hz), 4.75 - 4.80 (1H, m), 7.03 (2H, d, J = 8.8 Hz), 7.24 (1H, d, J = 8.4 Hz), 7.48 - 7.55 (3H, m), 7.65 (1H, d, J = 1.8 Hz), 7.73 (1H, s).

IR (neat) v: 2948, 2874, 1713, 1661 cm⁻¹.

Reference Example 99

[0259] In methanol (25ml) and THF (25ml) was dissolved methyl 1-propionyl-7-(2-propoxyethoxy)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g), and to the solution was added 1N sodium hydroxide solution (5ml). The mixture was stirred at room temperature overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-propionyl-7-(2-propoxyethoxy)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.2g) as colorless crystals.

¹H-NMR (δ ppm, CDCl₃) 0.95 (3H, t, J = 7.3 Hz), 1.07 (3H, t, J = 7.5 Hz), 1.57 - 1.75 (2H, m), 2.12 - 2.22 (1H, m), 2.43 - 2.55 (1H, m), 2.78 - 2.88 (2H, m), 3.00 - 3.10 (1H, m), 3.53 (2H, t, J = 6.8 Hz), 3.83 (2H, t, J = 5.0 Hz), 4.19 (2H, t, J = 5.0 Hz), 4.78 - 4.80 (1H, m), 7.03 (2H, d, J = 8.6 Hz), 7.26 (1H, d, J = 8.2 Hz), 7.51 - 7.56 (3H, m), 7.67 (1H, d, J = 1.4 Hz), 7.83 (1H, s).

IR (KBr) v: 2940, 2876, 1705 cm⁻¹.

Reference Example 100

[0260] In 1,2-dichloroethane (20) were dissolved methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g), n-butylaldehyde (1.3ml) and acetic acid (0.41ml), and to the solution was added sodium triacetoxyborohydride (3.8g). The mixture was stirred at room temperature overnight, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-bromo-1-butyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.9g) as pale yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.96 (3H, t, J = 7.2 Hz), 1.27 - 1.45 (2H, m), 1.56 - 1.72 (2H, m), 2.79 (2H, t, J = 4.2 Hz), 3.19 - 3.31 (4H, m), 3.80 (3H, s), 6.69 (1H, d, J = 8.8 Hz), 7.23 (1H, dd, J = 2.5, 8.8 Hz), 7.42 (1H, d, J = 2.5 Hz), 7.57 (1H, s).

Reference Example 101

[0261] A mixture of methyl 7-bromo-1-butyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.45g), 4-(2-propoxyethoxy)phenyl borate (0.66g), 1M potassium carbonate solution (4ml), ethanol (4ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.12g), and the mixture was refluxed overnight under argon atmosphere and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-butyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.5g) as pale yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.91 - 1.01 (6H, m), 1.30 - 1.45 (2H, m), 1.57 - 1.73 (4H, m), 2.80 (2H, t, J = 4.6 Hz), 3.25-3.37 (4H, m), 3.51 (2H, t, J = 6.1 Hz), 3.78 - 3.83 (5H, m), 4.16 (2H, t, J = 4.9 Hz), 6.87 (1H, d, J = 8.4 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.37 - 7.51 (4H, m), 7.76 (1H, s).

IR (neat) v: 2959, 2928, 2870, 1698, 1607, 1501 cm⁻¹.

Reference Example 102

[0262] In methanol (25ml) and THF (25ml) was dissolved methyl 1-butyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.5g). To the solution was added 1N sodium hydroxide solution (17ml), and the mixture was heated to stir at 50°C for 5 hours, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl

acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-butyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.38g) as yellow crystals.

mp 176 - 177°C.

¹H-NMR (δ ppm, CDCl₃) 0.91 - 1.02 (6H, m), 1.35 - 1.46 (2H, m), 1.60 - 1.74 (4H, m), 2.84 (2H, t-like), 3.32 - 3.39 (4H, m), 3.52 (2H, t, J = 6.8 Hz), 3.81 (2H, t, J = 5.1 Hz), 4.17 (2H, t, J = 5.1 Hz), 6.88 (1H, d, J = 9.2 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.40 - 7.53 (4H, m), 7.88 (1H, s).

IR (KBr) ν: 2959, 2932, 2872, 1669, 1607, 1501 cm⁻¹.

Anal. Calcd. for C₂₆H₃₃NO₄: C, 73.73; H, 7.85; N, 3.31. Found C, 73.42; H, 7.86; N, 3.25.

Reference Example 103

[0263] To cyclopropylamine (50ml) was added dropwise t-butyl 4-bromobutyrate (33.5g) at 40°C. To the mixture was added sodium iodide (22.6g), and the mixture was refluxed overnight. The solvent was evaporated, and to the residue was added water. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified by distillation under reduced pressure to give t-butyl N-cyclopropyl-4-aminobutyrate (12.6g) as colorless oil.

bp 85 - 90°C/5 mm.

¹H-NMR (δ ppm, CDCl₃) 0.27 - 0.47 (4H, m), 1.45 (9H, s), 1.69 - 1.84 (2H, m), 2.08 - 2.15 (1H, m), 2.26 (2H, t, J = 7.3 Hz), 2.71 (2H, t, J = 7.3 Hz).

Reference Example 104

[0264] 5-bromo-2-fluorobenzaldehyde (20g), t-butyl N-cyclopropyl-4-aminobutyrate (14.5g), sodium carbonate (13.8g), water (70ml) and DMSO (70ml) were heated at 80°C for 5 days and at 110°C for 3 days, which was poured into water and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give t-butyl N-(4-bromo-2-formylphenyl)-N-cyclopropyl-4-aminobutyrate (6.4g) as red oil.

¹H-NMR (δ ppm, CDCl₃) 0.45 - 0.52 (2H, m), 0.72 - 0.78 (2H, m), 1.41 (9H, s), 1.88 - 1.98 (2H, m), 2.17 (2H, t, J = 7.1 Hz), 2.66 - 2.73 (1H, m), 3.29 (2H, t, J = 7.5 Hz), 7.13 (1H, d, J = 8.8 Hz), 7.53 (1H, dd, J = 2.6, 8.8 Hz), 7.84 (1H, d, J = 2.6 Hz), 10.09 (1H, s).

Reference Example 105

[0265] In THF (10ml) was dissolved t-butyl N-(4-bromo-2-formylphenyl)-N-cyclopropyl-4-aminobutyrate (1g). To the solution was added potassium t-butoxide (0.59g), and the mixture was heated at 55°C for 1.5 hours. The solvent was evaporated, which was extracted with water. The aqueous layer was washed with ethyl acetate, and neutralized by addition of 1N hydrochloric acid, and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-bromo-1-cyclopropyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.44g) as yellow crystals. mp 225 - 230°C (dec.).

¹H-NMR (δ ppm, CDCl₃) 0.42 - 0.50 (2H, m), 0.80 - 0.84 (2H, m), 2.60 - 2.80 (3H, m), 3.24 - 3.34 (2H, m), 7.13 (1H, d, J = 8.8 Hz), 7.38 (1H, dd, J = 2.4, 8.8 Hz), 7.45 (1H, s), 7.53 (1H, d, J = 2.4 Hz), 12.39 (1H, br).

Anal. Calcd. for C₁₄H₁₄BrNO₂: C, 54.56; H, 4.58; N, 4.55. Found C, 54.20; H, 4.60; N, 4.30.

Reference Example 106

[0266] In THF (15ml) was dissolved 7-bromo-1-cyclopropyl-2,3-dihydro-1H-benzazepine-4-carboxylic acid (0.4g). Under ice-cooling, to the solution were added oxalyl chloride (0.26ml) and DMF (catalytic amount), and the mixture was stirred at room temperature for 30 minutes. The solvent was evaporated under reduced pressure. In THF (30ml) was dissolved the residue, and the solution was added dropwise to a solution of 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline (0.34g) and triethylamine (0.9ml) in THF (5ml) under ice-cooling. The mixture was stirred under nitrogen atmosphere at room temperature overnight. The solvent was evaporated under reduced pressure. Water was added to the residue, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/ triethylamine) to give 7-bromo-1-cyclopropyl-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (0.55g) as yellow crystals.

mp 133 - 136°C.

¹H-NMR (δ ppm, CDCl₃) 0.50 - 0.58 (2H, m), 0.79 - 0.88 (2H, m), 1.63 - 1.76 (4H, m), 2.20 (3H, s), 2.58 - 2.71 (2H, m), 2.86 (2H, t, J = 8.8 Hz), 3.37 (2H, dt, J = 3.0, 11.4 Hz), 3.46 (2H, t, J = 4.9 Hz), 3.56 (2H, s), 4.01 - 4.07 (2H, m), 7.08 (1H, d, J = 8.8 Hz), 7.14 (1H, s), 7.26 - 7.32 (2H, m), 7.37 (1H, d, J = 2.6 Hz), 7.52 (2H, d, J = 8.8 Hz), 7.57 (1H, s).

Anal. Calcd. for C₂₇H₃₂BrN₃O₂: C, 63.53; H, 6.32; N, 8.23. Found C, 63.30; H, 6.26; N, 8.15.

Reference Example 107

[0267] In DMF (3ml) was dissolved methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g), and the solution was added dropwise to a suspension of 60% sodium hydride (0.05g) in DMF (1ml) under ice-cooling. The mixture was stirred under nitrogen atmosphere for 10 minutes. Benzyl bromide (0.15ml) was added thereto, and the mixture was heated at 45°C for 4 hours. The mixture was poured into water, and extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-benzyl-7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 2.75 (2H, t, J = 4.9 Hz), 3.26 (2H, t, J = 4.9 Hz), 3.80 (3H, s), 4.52 (2H, s), 6.67 (1H, d, J = 8.8 Hz), 7.19 (1H, dd, J = 2.4, 8.8 Hz), 7.22 - 7.45 (6H, m), 7.47 (1H, d, J = 2.4 Hz), 7.63 (1H, s).
IR (neat) v: 1703 cm⁻¹.

Reference Example 108

[0268] A mixture of methyl 1-benzyl-7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g), 4-(2-propoxyethoxy)phenyl borate (0.24g), 1M potassium carbonate solution (2.5ml), ethanol (2.5ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.04g), and the mixture was refluxed under argon atmosphere overnight. The mixture was extracted with ethyl acetate, and the organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-benzyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.27g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.5 Hz), 1.58 - 1.70 (2H, m), 2.77 (2H, t, J = 4.6 Hz), 3.32 (2H, t, J = 4.6 Hz), 3.51 (2H, t, J = 6.8 Hz), 3.78 - 3.83 (2H, m), 3.81 (3H, s), 4.07 - 4.18 (2H, m), 4.59 (2H, s), 6.87 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.41 (6H, m), 7.47 (2H, d, J = 8.8 Hz), 7.56 (1H, d, J = 2.2 Hz), 7.83 (1H, s).
IR (neat) v: 3027, 2874, 1701, 1499 cm⁻¹.

Reference Example 109

[0269] In methanol (10ml) and THF (10ml) was dissolved methyl 1-benzyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.27g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was stirred at room temperature overnight and concentrated, which was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-benzyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.16g) as yellow crystals.

mp 139 - 142°C.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.59 - 1.70 (2H, m), 2.80 (2H, t, J = 4.6 Hz), 3.34 (2H, t, J = 4.6 Hz), 3.52 (2H, t, J = 6.8 Hz), 3.78 - 3.84 (2H, m), 4.14 - 4.19 (2H, m), 4.61 (2H, s), 6.87 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.49 (8H, m), 7.57 (1H, d, J = 2.2 Hz), 7.95 (1H, s).
IR (KBr) v: 2934, 2870, 1674, 1607, 1501 cm⁻¹.
Anal. Calcd. for C₂₉H₃₁NO₄: C, 76.12; H, 6.83; N, 3.06. Found C, 75.77; H, 6.95; N, 3.15.

Reference Example 110

[0270] In 1,2-dichloroethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g) and benzaldehyde (0.43g). To the solution was added sodium triacetoxymethylborohydride (0.43g), and the mixture was stirred under nitrogen atmosphere at room temperature overnight, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 1-benzyl-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.49g) as oil.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.30 - 1.48 (2H, m), 1.54 - 1.68 (2H, m), 2.77 (2H, t, J = 4.7 Hz), 3.31

(2H, t, J = 4.7 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.82 (5H, m), 4.15 (2H, t, J = 4.8 Hz), 4.59 (2H, s), 6.86 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.26 - 7.68 (7H, m), 7.82 - 7.91 (3H, m).

IR (neat) ν : 2934, 2870, 1703, 1607, 1501 cm^{-1} .

5 Reference Example 111

[0271] In methanol (25ml) and THF (25ml) was dissolved methyl 1-benzyl-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.49g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was heated at 50°C overnight and concentrated, which was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-benzyl-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.47g) as yellow crystals.

mp 133 - 138°C.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 0.93 (3H, t, J = 7.4 Hz), 1.34 - 1.45 (2H, m), 1.54 - 1.65 (2H, m), 2.80 (2H, br), 3.34 (2H, br), 3.56 (2H, t, J = 6.6 Hz), 3.80 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 4.61 (2H, s), 6.88 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.49 (8H, m), 7.57 (1H, d, J = 2.2 Hz), 7.94 (1H, s).

IR (KBr) ν : 2957, 2934, 2867, 1674, 1609, 1501 cm^{-1} .

Anal. Calcd. for $\text{C}_{30}\text{H}_{33}\text{NO}_4$: C, 76.41; H, 7.05; N, 2.97. Found C, 76.06; H, 7.15; N, 2.68.

20 Reference Example 112

[0272] In 1,2-dichloroethane (5ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) and cyclohexanecarbaldehyde (0.43g). To the solution was added sodium triacetoxymethylborohydride (0.43g), and the mixture was stirred under nitrogen atmosphere at room temperature for 3.5 hours, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclohexylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.37g) as pale yellow oil.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 0.89 - 1.81 (15H, m), 0.93 (3H, t, J = 7.3 Hz), 2.81 (2H, t, J = 4.2 Hz), 3.19 (2H, d, J = 6.6 Hz), 3.29 (2H, t, J = 4.8 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.78-3.82 (5H, m), 4.15 (2H, t, J = 4.9 Hz), 6.87 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.36 - 7.51 (4H, m), 7.76 (1H, s).

IR (neat) ν : 2930, 2849, 1699, 1607, 1499 cm^{-1} .

Reference Example 113

[0273] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclohexylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.37g). To the solution was added 1N sodium hydroxide solution (7.5ml), and the mixture was stirred at room temperature overnight and concentrated, which was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclohexylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.32g) as yellow crystals.

mp 124 - 125°C.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 0.90 - 1.85 (15H, m), 0.93 (3H, t, J = 7.2 Hz), 2.83 (2H, t-like), 3.22 (2H, d, J = 6.6 Hz), 3.32 (2H, t-like), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.89 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.39 - 7.53 (4H, m), 7.88 (1H, s).

IR (KBr) ν : 2926, 1674, 1607, 1499 cm^{-1} .

Anal. Calcd. for $\text{C}_{30}\text{H}_{39}\text{NO}_4$: C, 75.44; H, 8.23; N, 2.93. Found C, 75.46; H, 8.23; N, 2.96.

Reference Example 114

[0274] In 1,2-dichloroethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g) and cyclopropanecarbaldehyde (0.3g). To the solution was added sodium triacetoxymethylborohydride (0.43g), and the mixture was stirred under nitrogen atmosphere at room temperature overnight, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.45g) as yellow oil.

$^1\text{H-NMR}$ (δ ppm, CDCl_3) 0.24 - 0.32 (2H, m), 0.58 - 0.67 (2H, m), 0.93 (3H, t, J = 7.3 Hz), 1.08 - 1.15 (1H, m), 1.34 -

1.49 (2H, m), 1.55 - 1.68 (2H, m), 2.86 (2H, t, J = 4.4 Hz), 3.23 (2H, d, J = 6.6 Hz), 3.39 (2H, t, J = 4.7 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.73 - 3.83 (5H, m), 4.11 - 4.18 (2H, m), 6.92 - 7.01 (3H, m), 7.38 - 7.53 (4H, m), 7.77 (1H, s). IR (neat) ν : 2953, 2930, 2870, 1699, 1607, 1499 cm^{-1} .

5 Reference Example 115

[0275] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.45g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was stirred at room temperature overnight and concentrated, which was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclopropylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.42g) as yellow crystals.

mp 152 - 155°C.

¹H-NMR (δ ppm, CDCl_3) 0.25 - 0.33 (2H, m), 0.59 - 0.68 (2H, m), 0.93 (3H, t, J = 7.3 Hz), 1.05 - 1.20 (1H, m), 1.30 - 1.49 (2H, m), 1.55 - 1.69 (2H, m), 2.87 (2H, t, J = 4.6 Hz), 3.25 (2H, d, J = 6.4 Hz), 3.42 (2H, t, J = 4.6 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.93 - 7.00 (3H, m), 7.40 - 7.54 (4H, m), 7.89 (1H, s). IR (KBr) ν : 2959, 2936, 2868, 1669, 1607, 1501 cm^{-1} . Anal. Calcd. for $\text{C}_{27}\text{H}_{33}\text{NO}_4$: C, 74.45; H, 7.64; N, 3.22. Found C, 74.27; H, 7.45; N, 3.21.

20 Reference Example 116

[0276] In 1,2-dichloroethane (5ml) were dissolved methyl 7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) and cyclopropanecarbaldehyde (0.22g). To the solution was added sodium triacetoxymethylborohydride (0.33g), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 hours, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 1-cyclopropylmethyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.34g) as yellow oil.

¹H-NMR (δ ppm, CDCl_3) 0.24 - 0.32 (2H, m), 0.58 - 0.67 (2H, m), 0.94 (3H, t, J = 7.5 Hz), 1.05 - 1.15 (1H, m), 1.60 - 1.74 (2H, m), 2.85 (2H, t, J = 4.6 Hz), 3.23 (2H, d, J = 6.6 Hz), 3.39 (2H, t, J = 4.6 Hz), 3.51 (2H, t, J = 6.7 Hz), 3.79 - 3.84 (5H, m), 4.16 (2H, t, J = 5.0 Hz), 6.91 - 7.01 (3H, m), 7.38 - 7.52 (4H, m), 7.77 (1H, s). IR (neat) ν : 2936, 2872, 1699, 1607, 1499 cm^{-1} .

Reference Example 117

[0277] In methanol (25ml) and THF (25ml) was dissolved methyl 1-cyclopropylmethyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.34g). To the solution was added 1N sodium hydroxide solution (7.5ml), and the mixture was stirred at room temperature overnight, heated at 50°C for 1 hour, concentrated, which was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-cyclopropylmethyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.30g) as yellow crystals.

mp 154 - 156°C.

¹H-NMR (δ ppm, CDCl_3) 0.25 - 0.33 (2H, m), 0.59 - 0.68 (2H, m), 0.95 (3H, t, J = 7.3 Hz), 1.05 - 1.18 (1H, m), 1.56 - 1.74 (2H, m), 2.87 (2H, t, J = 4.8 Hz), 3.25 (2H, d, J = 6.2 Hz), 3.42 (2H, t, J = 4.8 Hz), 3.51 (2H, t, J = 6.8 Hz), 3.81 (2H, t, J = 4.9 Hz), 4.17 (2H, t, J = 4.9 Hz), 6.93-7.00 (3H, m), 7.40 - 7.53 (4H, m), 7.88 (1H, s). IR (KBr) ν : 2963, 1669, 1518 cm^{-1} . Anal. Calcd. for $\text{C}_{26}\text{H}_{31}\text{NO}_4$: C, 74.08; H, 7.41; N, 3.32. Found C, 74.03; H, 7.53; N, 3.27.

Reference Example 118

[0278] In 1,2-dichloroethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g) and cyclobutanecarbaldehyde (0.5g). To the solution was added sodium triacetoxymethylborohydride (0.43g), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 hours, poured into water, neutralized with sodium hydrogen carbonate solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclobutylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.47g) as yellow oil.

¹H-NMR (δ ppm, CDCl_3) 0.93 (3H, t, J = 7.3 Hz), 1.34 - 1.45 (2H, m), 1.54 - 2.13 (8H, m), 2.70 - 2.81 (3H, m), 3.26

(2H, t, J = 4.8 Hz), 3.38 (2H, d, J = 7.4 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (5H, m), 4.16 (2H, t, J = 4.9 Hz), 6.87 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.37-7.51 (4H, m), 7.75 (1H, s)

Reference Example 119

5

[0279] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-cyclobutylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.47g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was heated at 50°C overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-cyclobutylmethyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.40g) as yellow crystals.

10

mp 110 - 112°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.30 - 2.00 (8H, m), 2.00 - 2.15 (2H, m), 2.71 - 2.80 (3H, m), 3.29 (2H, t, J = 4.8 Hz), 3.39 (2H, d, J = 7.0 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.80 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.88 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.39-7.51 (4H, m), 7.85 (1H, s).

15

Anal. Calcd. for C₂₈H₃₅NO₄: C, 74.80; H, 7.85; N, 3.12. Found C, 74.51; H, 7.92; N, 2.98.

Reference Example 120

[0280] In dichloromethane (15ml) were dissolved methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.5g) and copper pivalate (0.05g). To the solution was added triphenylbismuth diacetate (1.1g), and the mixture was stirred at room temperature overnight, poured into water, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-bromo-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.27g) as yellow crystals.

25

mp 104 - 106°C.

¹H-NMR (δ ppm, CDCl₃) 2.82 (2H, t, J = 4.4 Hz), 3.76 (2H, t, J = 4.4 Hz), 3.78 (3H, s), 6.90 - 7.00 (4H, m), 7.22 - 7.30 (3H, m), 7.58 (1H, d, J = 2.2 Hz), 7.62 (1H, s).

30

IR (KBr) ν: 2949, 1705 cm⁻¹.

Anal. calcd for C₁₈H₁₆BrNO₂: C, 60.35; H, 4.50; N, 3.91. Found C, 60.16; H, 4.28; N, 3.85.

Reference Example 121

[0281] A mixture of methyl 7-bromo-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.27g), 4-(2-propoxyethoxy)phenyl borate (0.23g), 1M potassium carbonate solution (3ml), ethanol (3ml) and toluene (25ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine) palladium (0.04g), and the mixture was refluxed under argon atmosphere overnight, and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 1-phenyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.26g) as yellow crystals.

40

mp 117 - 119°C.

¹H-NMR (δ ppm, CDCl₃) 0.95 (3H, t, J = 7.5 Hz), 1.57 - 1.71 (2H, m), 2.85 (2H, t, J = 4.6 Hz), 3.52 (2H, t, J = 6.8 Hz), 3.79 (3H, s), 3.79 - 3.84 (4H, m), 4.18 (2H, t, J = 5.0 Hz), 6.87 - 7.03 (5H, m), 7.16 - 7.30 (3H, m), 7.40 (1H, dd, J = 2.2, 8.4 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.64 (1H, d, J = 2.2 Hz), 7.80 (1H, s).

45

IR (KBr) ν: 1705, 1493 cm⁻¹.

Anal. Calcd. for C₂₉H₃₁NO₄: C, 76.12; H, 6.83; N, 3.06. Found C, 75.81; H, 6.75; N, 2.77.

50 Reference Example 122

[0282] In methanol (25ml) and THF (25ml) was dissolved methyl 1-phenyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.23g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was heated at 50°C overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-phenyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.23g) as yellow crystals.

55

mp 135 - 139°C.

¹H-NMR (δ ppm, CDCl₃) 0.95 (3H, t, J = 7.5 Hz), 1.60 - 1.71 (2H, m), 2.86 (2H, t-like), 3.52 (2H, t, J = 6.7 Hz), 3.80 - 3.85 (4H, m), 4.18 (2H, t, J = 4.8 Hz), 6.90 - 7.04 (5H, m), 7.17 (1H, d, J = 8.5 Hz), 7.23 - 7.31 (2H, m), 7.40 (1H, dd, J = 2.2, 8.5 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.65 (1H, d, J = 2.2 Hz), 7.90 (1H, s).
 IR (KBr) ν: 2963, 2936, 2872, 1674, 1609, 1593, 1493 cm⁻¹. Anal. Calcd. for C₂₈H₂₉NO₄: C, 75.82; H, 6.59; N, 3.16.
 Found C, 75.43; H, 6.37; N, 3.10.

Reference Example 123

[0283] In dichloromethane (10ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.5g) and copper pivalate (0.07g). To the solution was added triphenylbismuth diacetate (0.78g), and the mixture was stirred at room temperature overnight, poured into 3N hydrochloric acid, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.42g) as yellow crystals.
 mp 80 - 82°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.1 Hz), 1.31 - 1.49 (2H, m), 1.56 - 1.69 (2H, m), 2.85 (2H, t, J = 4.4 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.79 - 3.84 (7H, m), 4.17 (2H, t, J = 4.9 Hz), 6.87 - 7.02 (5H, m), 7.16 - 7.30 (3H, m), 7.40 (1H, dd, J = 2.2, 8.8 Hz), 7.51 (2H, d, J = 8.4 Hz), 7.64 (1H, d, J = 2.2 Hz), 7.80 (1H, s).
 IR (KBr) ν: 2955, 2868, 1705, 1593, 1495 cm⁻¹.
 Anal. Calcd. for C₃₀H₃₃NO₄: C, 76.41; H, 7.05; N, 2.97. Found C, 76.30; H, 7.17; N, 2.90.

Reference Example 124

[0284] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.37g). To the solution was added 1N sodium hydroxide solution (7.5ml), and the mixture was stirred at room temperature overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.27g) as yellow crystals.
 mp 129 - 131°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.34 - 1.49 (2H, m), 1.55 - 1.69 (2H, m), 2.86 (2H, t, J = 4.4 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.79 - 3.84 (4H, m), 4.17 (2H, t, J = 4.8 Hz), 6.90 - 7.04 (5H, m), 7.17 (1H, d, J = 8.6 Hz), 7.23 - 7.31 (2H, m), 7.40 (1H, dd, J = 2.2, 8.6 Hz), 7.50 (2H, d, J = 7.2 Hz), 7.64 (1H, d, J = 1.8 Hz), 7.90 (1H, s). IR (KBr) ν: 2957, 2870, 1674, 1609, 1593, 1493 cm⁻¹.
 Anal. Calcd. for C₂₉H₃₁NO₄: C, 76.12; H, 6.83; N, 3.06. Found C, 76.18; H, 6.85; N, 3.21.

Reference Example 125

[0285] In dichloromethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) and copper pivalate (0.04g). To the solution was added tri(3-methoxyphenyl)bismuth diacetate (1.5g), and the mixture was stirred at room temperature overnight, poured into 3N hydrochloric acid, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.16g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.34 - 1.45 (2H, m), 1.55 - 1.65 (2H, m), 2.86 (2H, t, J = 4.8 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.75 (3H, s), 3.79 (3H, s), 3.79 - 3.84 (4H, m), 4.17 (2H, t, J = 4.9 Hz), 6.42 - 6.60 (3H, m), 7.00 (2H, d, J = 8.8 Hz), 7.11 - 7.26 (2H, m), 7.41 (1H, dd, J = 2.2, 8.4 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.64 (1H, d, J = 2.2 Hz), 7.78 (1H, s).
 IR (neat) ν: 2955, 2932, 2870, 1705 cm⁻¹.

Reference Example 126

[0286] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.16g). To the solution was added 1N sodium hydroxide solution (2.8ml), and the mixture was heated at 50°C overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium

sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.16g) as yellow crystals.

mp 154- 156°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.4 Hz), 1.34 - 1.45 (2H, m), 1.55 - 1.65 (2H, m), 2.87 (2H, t-like), 3.56 (2H, t, J = 6.6 Hz), 3.76 (3H, s), 3.79 - 3.84 (4H, m), 4.17 (2H, t, J = 4.8 Hz), 6.45 - 6.61 (3H, m), 7.00 (2H, d, J = 8.8 Hz), 7.13 - 7.24 (2H, m), 7.42 (1H, dd, J = 2.2, 8.4 Hz), 7.51 (2H, d, J = 8.8 Hz), 7.64 (1H, d, J = 2.2 Hz), 7.88 (1H, s)
Anal. Calcd. for C₃₀H₃₃NO₅: C, 73.90; H, 6.82; N, 2.87. Found C, 73.73; H, 6.72; N, 2.83.

Reference Example 127

[0287] In dichloromethane (10ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) and copper pivalate (0.06g). To the solution was added tri(4-methoxyphenyl)bismuth diacetate (1.5g), and the mixture was stirred at room temperature overnight, poured into 3N hydrochloric acid, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.38g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.2 Hz), 1.30 - 1.45 (2H, m), 1.55 - 1.65 (2H, m), 2.82 (2H, t, J = 4.4 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.72 - 3.83 (10H, m), 4.16 (2H, t, J = 4.4 Hz), 6.85 - 6.91 (3H, m), 6.96 - 7.04 (4H, m), 7.30 (1H, dd, J = 2.2, 8.4 Hz), 7.48 (2H, d, J = 8.8 Hz), 7.59 (1H, d, J = 2.2 Hz), 7.82 (1H, s).

IR (neat) ν: 2955, 1705, 1609, 1508, 1491 cm⁻¹.

Reference Example 128

[0288] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.38g). To the solution was added 1N sodium hydroxide solution (8ml), and the mixture was heated at 50°C overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(4-methoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.27g) as yellow crystals.

mp 164 - 166°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.1 Hz), 1.34 - 1.49 (2H, m), 4.54 - 1.68 (2H, m), 2.83 (2H, t-like), 3.55 (2H, t, J = 6.0 Hz), 3.74 - 3.83 (7H, m), 4.16 (2H, t, J = 4.9 Hz), 6.85 - 7.06 (7H, m), 7.31 (1H, dd, J = 2.2, 8.4 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.59 (1H, d, J = 2.2 Hz), 7.92 (1H, s).

IR (KBr) ν: 2957, 2928, 2868, 1674, 1609, 1508, 1493 cm⁻¹. Anal. Calcd. for C₃₀H₃₃NO₅: C, 73.90; H, 6.82; N, 2.87. Found C, 73.87; H, 6.89; N, 2.70.

Reference Example 129

[0289] In dichloromethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.2g) and copper pivalate (0.04g). To the solution was added tri(4-propoxyphenyl)bismuth diacetate (1.1g) and the mixture was stirred at room temperature overnight, poured into 3N hydrochloric acid, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.04 (3H, t, J = 7.5 Hz), 1.34 - 1.45 (2H, m), 1.54 - 1.68 (2H, m), 1.75 - 1.86 (2H, m), 2.81 (2H, t, J = 4.4 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.71 - 3.83 (7H, m), 3.90 (2H, t, J = 6.6 Hz), 4.14 - 4.18 (2H, m), 6.84 - 6.90 (3H, m), 6.96 - 7.02 (4H, m), 7.29 (1H, dd, J = 2.2, 8.4 Hz), 7.48 (2H, d, J = 6.6 Hz), 7.58 (1H, d, J = 2.2 Hz), 7.82 (1H, s).

IR (neat) ν: 2957, 2934, 2870, 1705, 1622, 1609, 1507, 1489 cm⁻¹.

Reference Example 130

[0290] In methanol (50ml) and THF (50ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g). To the solution was added 1N sodium hydroxide solution (5ml), and the mixture was heated at 50°C overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium

sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(4-propoxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.21g) as yellow crystals.
mp 182 - 185°C.

¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.1 Hz), 1.04 (3H, t, J = 7.6 Hz), 1.30 - 1.49 (2H, m), 1.54 - 1.68 (2H, m), 1.76 - 1.86 (2H, m), 2.83 (2H, t-like), 3.55 (2H, t, J = 6.6 Hz), 3.76 (2H, t-like), 3.80 (2H, t, J = 5.0 Hz), 3.91 (2H, t, J = 6.6 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.84 - 7.05 (7H, m), 7.30 (1H, dd, J = 2.2, 8.6 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.58 (1H, d, J = 2.2 Hz), 7.92 (1H, s).
IR (KBr) v: 2959, 2934, 2872, 1669, 1609, 1508, 1493 cm⁻¹. Anal. Calcd. for C₃₂H₃₇NO₅: C, 74.54; H, 7.23; N, 2.72. Found C, 74.19; H, 7.32; N, 2.87.

Reference Example 131

[0291] In dichloromethane (7ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.25g) and copper pivalate (0.05g). To the solution was added tri(3,4-methylenedioxyphenyl) bismuth diacetate (1.3g), and the mixture was stirred at room temperature overnight, poured into 3N hydrochloric acid, stirred, neutralized with 1N sodium hydroxide solution and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3,4-methylenedioxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g) as yellow oil.
¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.2 Hz), 1.30 - 1.49 (2H, m), 1.55 - 1.68 (2H, m), 2.82 (2H, t, J = 4.6 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.73 (2H, t, J = 4.9 Hz), 3.79 - 3.84 (5H, m), 4.17 (2H, t, J = 4.9 Hz), 5.94 (2H, s), 6.49 (1H, dd, J = 2.2, 8.4 Hz), 6.60 (1H, d, J = 2.2 Hz), 6.75 (1H, d, J = 8.4 Hz), 6.94 - 7.02 (3H, m), 7.33 (1H, dd, J = 2.2, 8.4 Hz), 7.48 (2H, d, J = 8.8 Hz), 7.59 (1H, d, J = 2.2 Hz), 7.80 (1H, s).
IR (neat) v: 2955, 2932, 2870, 1703, 1609, 1485 cm⁻¹.

Reference Example 132

[0292] In methanol (25ml) and THF (25ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3,4-methylenedioxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.3g). To the solution was added 1N sodium hydroxide solution (6ml), and the mixture was refluxed for 2 hours, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3,4-methylenedioxyphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.26g) as yellow crystals.
mp 145 - 148°C.
¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.3 Hz), 1.30 - 1.49 (2H, m), 1.55 - 1.68 (2H, m), 2.84 (2H, t, J = 5.2 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.74 (2H, t, J = 5.2 Hz), 3.81 (2H, t, J = 5.0 Hz), 4.17 (2H, t, J = 5.0 Hz), 5.95 (2H, s), 6.52 (1H, dd, J = 2.2, 8.4 Hz), 6.62 (1H, d, J = 2.2 Hz), 6.76 (1H, d, J = 8.4 Hz), 6.92 - 7.01 (3H, m), 7.34 (1H, dd, J = 2.2, 8.4 Hz), 7.48 (2H, d, J = 8.8 Hz), 7.59 (1H, d, J = 2.2 Hz), 7.91 (1H, s).
IR (KBr) v: 2932, 2867, 1678, 1609, 1486 cm⁻¹.
Anal. Calcd. for C₃₀H₃₂NO₆: C, 71.84; H, 6.23; N, 2.79. Found C, 71.61; H, 6.19; N, 2.62.

Reference Example 133

[0293] In THF (25ml) were dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1g) and pyridine (2ml). Under ice-cooling, to the solution was added dropwise chloroacetyl chloride (1ml). The mixture was stirred under nitrogen atmosphere at room temperature for 1 hour, and the solvent was evaporated. To the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-chloroacetyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g) as pale yellow oil.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.30 - 1.69 (4H, m), 2.78 - 3.13 (3H, m), 3.56 (2H, t, J = 6.6 Hz), 3.80 - 3.84 (5H, m), 3.93 (1H, d, J = 12.8 Hz), 4.11 - 4.20 (3H, m), 4.76 - 7.84 (1H, m), 7.03 (2H, d, J = 8.8 Hz), 7.34 (1H, d, J = 8.4 Hz), 7.50 - 7.58 (3H, m), 7.68 (1H, d, J = 1.8 Hz), 7.74 (1H, s).

Reference Example 134

[0294] In DMF (30ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-chloroacetyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g). To the solution was added sodium azide (0.23g), and the mixture was heated at 65°C

- for 1 hour, poured into water and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated, and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give pale yellow oil (0.8g), which was dissolved in THF (50ml). To the solution were added triphenylphosphine (1.1g) and water (catalytic amount), and the mixture was heated at 50°C for 1.5 hours. The solvent was evaporated and, to the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give pale yellow oil (0.7g), which was dissolved in THF (15ml). To the solution were added pyridine (0.7ml) and acetic anhydride (0.25ml), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. The solvent was evaporated and, to the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 1-(N-acetylglycyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.67g) as colorless crystals.
- mp 130 - 134°C.
- ¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.26 - 1.69 (4H, m), 2.01 (3H, s), 2.76 - 3.12 (3H, m), 3.51 - 3.62 (3H, m), 3.78 - 3.83 (5H, m), 4.16 (2H, t, J = 4.9 Hz), 4.33 (1H, dd, J = 4.0, 18.0 Hz), 4.73 - 4.80 (1H, m), 6.42 (1H, br), 7.03 (2H, d, J = 8.8 Hz), 7.28 (1H, d, J = 7.8 Hz), 7.49 - 7.56 (3H, m), 7.65 (1H, d, J = 2.2 Hz), 7.72 (1H, s).
- IR (KBr) ν: 3316, 2951, 2934, 2870, 1713, 1661 cm⁻¹.
- Anal. Calcd. for C₂₉H₃₄N₂O₆: C, 68.00; H, 6.93; N, 5.66.
- Found C, 67.84; H, 6.74; N, 5.61.

Reference Example 135

- [0295] In methanol (50ml) was dissolved methyl 1-(N-acetylglycyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.2g). To the solution was added 1N sodium hydroxide solution (13ml), and the mixture was stirred at room temperature overnight, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 1-(N-acetylglycyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (1.2g) as colorless crystals.
- mp 196 - 201°C.
- ¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.26 - 1.69 (4H, m), 2.02 (3H, s), 2.78 - 3.15 (3H, m), 3.53 - 3.62 (3H, m), 3.82 (2H, t, J = 4.9 Hz), 4.19 (2H, t, J = 4.9 Hz), 4.36 (1H, dd, J = 4.0, 18.0 Hz), 4.75 - 4.82 (1H, m), 6.53 (1H, br), 7.03 (2H, d, J = 8.8 Hz), 7.31 (1H, d, J = 8.0 Hz), 7.50 - 7.58 (3H, m), 7.67 (1H, d, J = 2.2 Hz), 7.81 (1H, s).
- IR (KBr) ν: 2951, 2872, 1669 cm⁻¹.
- Anal. Calcd. for C₂₇H₃₂N₂O₆: C, 66.86; H, 6.75; N, 5.78.
- Found C, 66.65; H, 6.73; N, 5.97.

Reference Example 136

- [0296] In DMF (20ml) were suspended 1-(N-acetylglycyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.85g), 4-[N-methyl-N-(tetrahydro-2H-pyran-4-yl)aminomethyl]aniline dihydrochloride (0.52g) and 1-hydroxybenzotriazole (0.3g). Under ice-cooling, to the suspension were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (1g), triethylamine (1.7ml) and 4-dimethylaminopyridine (catalytic amount), and the mixture was stirred at room temperature overnight. The solvent was evaporated and, to the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with basic silica gel column chromatography (ethyl acetate/methanol/triethylamine) to give 1-(N-acetylglycyl)-7-[4-(2-butoxyethoxy)phenyl]-N-[4-[[N-methyl-N-(tetrahydro-2H-pyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (1.1g) as pale yellow amorphous.
- ¹H-NMR (δ ppm, CDCl₃) 0.93 (3H, t, J = 7.4 Hz), 1.25 - 1.75 (8H, m), 2.05 (3H, s), 2.19 (3H, s), 2.55 - 2.70 (1H, m), 2.86 - 3.14 (3H, m), 3.37 (2H, dt, J = 2.6, 11.0 Hz), 3.53 - 3.71 (5H, m), 3.82 (2H, t, J = 5.0 Hz), 4.01 - 4.07 (2H, m), 4.11 - 4.28 (3H, m), 4.75 - 4.81 (1H, m), 6.49 (1H, br), 7.02 (2H, d, J = 8.4 Hz), 7.24 - 7.33 (4H, m), 7.43 - 7.61 (6H, m), 8.09 (1H, s).

Reference Example 137

- [0297] In toluene (25ml) were suspended methyl 7-[4-(2-butoxyethoxy)phenyl]-1-chloroacetyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.75g) and thioacetamide (0.36g). The suspension was heated at 90°C for 1 hour and

extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methylthiazol-4-yl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.17g) as yellow oil.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.26 - 1.65 (4H, m), 2.67 (3H, s), 2.86 (2H, t, J = 5.3 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.80 (3H, s), 3.81 (2H, t, J = 4.9 Hz), 3.95 (2H, t, J = 5.3 Hz), 4.17 (2H, t, J = 4.9 Hz), 5.92 (1H, s), 7.00 (2H, d, J = 8.8 Hz), 7.43 (2H, s), 7.51 (2H, d, J = 8.8 Hz), 7.62 (1H, s), 7.77 (1H, s).

Reference Example 138

[0298] In dichloromethane (15ml) was dissolved methyl 7-bromo-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.68g). Under ice-cooling, to the solution was added dropwise chlorosulfonic acid (0.32ml). The mixture was stirred at room temperature for 30 minutes and, to the mixture was additionally added chlorosulfonic acid (0.2ml), and the mixture was stirred at room temperature for 10 minutes. The reaction solution was added dropwise to aqueous ammonia (10ml) under ice-cooling, and the mixture was stirred for 30 minutes. The solvent was evaporated and, to the residue was added hot ethyl acetate. The insolubles were filtered and the solvent in the filtrate was evaporated. The precipitated methyl 7-bromo-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.33g) was collected by filtration and washed with ethyl acetate-hexane to give the carboxylate as yellow crystals.

mp 200 - 203°C.

¹H-NMR (δ ppm, CDCl₃) 2.89 (2H, t, J = 5.5 Hz), 3.78 (3H, s), 3.84 (2H, t, J = 5.5 Hz), 4.65 (2H, s), 6.87 (2H, d, J = 9.2 Hz), 7.18 (1H, d, J = 8.4 Hz), 7.43 (1H, dd, J = 2.2, 8.4 Hz), 7.60 (1H, s), 7.68 (1H, d, J = 2.2 Hz), 7.73 (2H, d, J = 9.2 Hz).

IR (KBr) ν: 1713 cm⁻¹.

Anal. Calcd. for C₁₈H₁₇BrN₂O₄S: C, 49.44; H, 3.92; N, 6.41. Found C, 49.30; H, 4.20; N, 6.04.

Reference Example 139

[0299] A mixture of methyl 7-bromo-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.31g), 4-(2-butoxyethoxy)phenyl borate (0.22g), 1M potassium carbonate solution (3ml), ethanol (5ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.04g), and the mixture was refluxed under argon atmosphere for 3 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.34g) as yellow crystals.

mp 163 - 165°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.35 - 1.46 (2H, m), 1.56 - 1.66 (2H, m), 2.92 (2H, t, J = 5.0 Hz), 3.57 (2H, t, J = 6.6 Hz), 3.79 (3H, s), 3.79 - 3.92 (4H, m), 4.18 (2H, t, J = 4.8 Hz), 4.73 (2H, s), 6.91 (2H, d, J = 9.2 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.34 (1H, d, J = 8.2 Hz), 7.50 - 7.56 (3H, m), 7.71 - 7.77 (4H, m).

IR (KBr) ν: 2957, 2934, 2870, 1705, 1590, 1493 cm⁻¹.

Anal. Calcd. for C₃₀H₃₄N₂NO₆S·0.25H₂O: C, 65.43; H, 6.22; N, 5.09. Found C, 65.04; H, 6.35; N, 4.91.

Reference Example 140

[0300] In methanol (50ml) and THF (15ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.34g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was refluxed for 2 hours, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.3g) as yellow crystals.

mp 185 - 195°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.1 Hz), 1.27 - 1.46 (2H, m), 1.55 - 1.66 (2H, m), 2.92 (2H, t-like), 3.57 (2H, t, J = 6.6 Hz), 3.82 (2H, t, J = 4.9 Hz), 3.90 (2H, t-like), 4.19 (2H, t, J = 4.9 Hz), 4.73 (2H, s), 6.93 (2H, d, J = 8.8 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.35 (1H, d, J = 8.0 Hz), 7.52 - 7.56 (3H, m), 7.72 - 7.76 (3H, m), 7.85 (1H, s). Anal. Calcd. for C₂₉H₃₂N₂O₆S: C, 64.91; H, 6.01; N, 5.22. Found C, 65.08; H, 6.17; N, 5.03.

Reference Example 141

[0301] In dichloromethane (10ml) was dissolved methyl 7-bromo-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.4g). Under ice-cooling, to the solution was added dropwise chlorosulfonic acid (0.74ml). The mixture was stirred at room temperature for 30 minutes and, to the mixture was additionally added chlorosulfonic acid (0.37ml), and the mixture was stirred at room temperature for 30 minutes. The reaction solution was added dropwise to 2M dimethylamine solution in methanol (35ml) under ice-cooling, and the mixture was stirred overnight. The solvent was evaporated and, to the residue was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-bromo-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.37g) as yellow crystals.
mp 210 - 213°C.
¹H-NMR (δ ppm, CDCl₃) 2.69 (6H, s), 2.90 (2H, t, J = 5.1 Hz), 3.79 (3H, s), 3.84 (2H, t, J = 5.1 Hz), 6.89 (2H, d, J = 9.2 Hz), 7.21 (1H, d, J = 8.4 Hz), 7.44 (1H, dd, J = 2.2, 8.4 Hz), 7.57 - 7.62 (3H, m), 7.68 (1H, d, J = 2.2 Hz).
IR (KBr) ν: 2955, 1709, 1595, 1582, 1501, 1483 cm⁻¹.
Anal. Calcd. for C₂₀H₂₁BrN₂O₄S: C, 51.62; H, 4.55; N, 6.02. Found C, 51.60; H, 4.55; N, 5.78.

Reference Example 142

[0302] A mixture of methyl 7-bromo-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.35g), 4-(2-butoxyethoxy)phenyl borate (0.19g), 1M potassium carbonate solution (2ml), ethanol (2ml) and toluene (50ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (0.04g), and the mixture was refluxed under argon atmosphere for 6 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.35g) as colorless crystals.
mp 150 - 153°C.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.3 Hz), 1.35 - 1.66 (4H, m), 2.69 (6H, s), 2.93 (2H, t-like), 3.57 (2H, t, J = 6.6 Hz), 3.80 (3H, s), 3.80 - 3.89 (4H, m), 4.19 (2H, t, J = 5.0 Hz), 6.94 (2H, d, J = 8.8 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.38 (1H, d, J = 8.4 Hz), 7.51 - 7.62 (5H, m), 7.71 (1H, s), 7.78 (1H, s).
IR (KBr) ν: 2959, 2868, 1709, 1590, 1495 cm⁻¹.
Anal. Calcd. for C₃₂H₃₈N₂O₆S: C, 66.41; H, 6.62; N, 4.84. Found C, 66.25; H, 6.89; N, 4.76.

Reference Example 143

[0303] In methanol (50ml) and THF(50ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.34g). To the solution was added 1N sodium hydroxide solution (10ml), and the mixture was stirred at room temperature at 60°C for 1 hour, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(N,N-dimethyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.33g) as yellow crystals.
mp 236 - 238°C.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.1 Hz), 1.30 - 1.50 (2H, m), 1.56 - 1.66 (2H, m), 2.69 (6H, s), 2.93 (2H, t-like), 3.57 (2H, t, J = 6.6 Hz), 3.83 (2H, t, J = 4.8 Hz), 3.91 (2H, t-like), 4.19 (2H, t, J = 4.8 Hz), 6.96 (2H, d, J = 9.2 Hz), 7.03 (2H, d, J = 8.8 Hz), 7.39 (1H, d, J = 8.6 Hz), 7.52 - 7.63 (5H, m), 7.72 (1H, d, J = 2.2 Hz), 7.88 (1H, s).
IR (KBr) ν: 2959, 2934, 2872, 1671, 1590, 1501, 1491 cm⁻¹. Anal. Calcd. for C₃₁H₃₆N₂O₆S: C, 65.94; H, 6.43; N, 4.96. Found C, 65.82; H, 6.46; N, 4.85.

Reference Example 144

[0304] In dichloromethane (20ml) was dissolved methyl 7-bromo-1-phenyl-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1g). Under ice-cooling, to the solution was added dropwise chlorosulfonic acid (0.93ml). The mixture was stirred at room temperature for 1 hour, and the reaction solution was added dropwise to 40% methylamine solution in water (25ml) under ice-cooling. The mixture was stirred at room temperature overnight, concentrated and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give methyl 7-bromo-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1g) as yellow crystals.

mp 201 - 204°C.

¹H-NMR (δ ppm, CDCl₃) 2.65 (3H, d, J = 5.4 Hz), 2.90 (2H, t, J = 4.6 Hz), 3.79 (3H, s), 3.84 (2H, t, J = 4.6 Hz), 4.23 (1H, q, J = 5.4 Hz), 6.88 (2H, d, J = 9.0 Hz), 7.30 (1H, d, J = 8.8 Hz), 7.44 (1H, dd, J = 2.2, 8.8 Hz), 7.57 - 7.69 (4H, m).

IR (KBr) ν: 3277, 2953, 1705, 1595, 1501 cm⁻¹.

Anal. Calcd. for C₁₉H₁₉BrN₂O₄S: C, 50.56; H, 4.24; N, 6.21. Found C, 50.62; H, 4.20; N, 6.48.

Reference Example 145

[0305] A mixture of methyl 7-bromo-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1g), 4-(2-butoxyethoxy)phenyl borate (0.69g), 1M potassium carbonate solution (8ml), ethanol (8ml) and toluene (100ml) was stirred under argon atmosphere at room temperature for 30 minutes. To the mixture was added tetrakis (triphenylphosphine)palladium (0.13g), and the mixture was refluxed under argon atmosphere for 2.5 hours and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated under reduced pressure and the residue was purified with silica gel column chromatography (ethyl acetate/hexane) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g) as colorless crystals.

mp 142 - 146°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.35 - 1.46 (2H, m), 1.57 - 1.66 (2H, m), 2.65 (3H, d, J = 5.6 Hz), 2.92 (2H, t, J = 4.8 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.80 (3H, s), 3.80 - 3.92 (4H, m), 4.10 - 4.21 (3H, m), 6.92 (2H, d, J = 8.8 Hz), 7.03 (2H, d, J = 8.6 Hz), 7.36 (1H, d, J = 8.4 Hz), 7.50 - 7.56 (3H, m), 7.67 (2H, d, J = 8.8 Hz), 7.71 (1H, d, J = 2.2 Hz), 7.77 (1H, s).

IR (KBr) ν: 2957, 1709, 1590, 1495 cm⁻¹.

Anal. Calcd. for C₃₁H₃₈N₂O₆S: C, 65.94; H, 6.43; N, 4.69. Found C, 65.76; H, 6.36; N, 4.81.

Reference Example 146

[0306] In methanol (100ml) and THF (100ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.1g). To the solution was added 1N sodium hydroxide solution (19ml), and the mixture was heated at 50°C for 6 hours, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(N-methyl-4-sulfamoylphenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1g) as pale yellow crystals.

mp 208 - 210°C.

¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.1 Hz), 1.31 - 1.50 (2H, m), 1.55 - 1.69 (2H, m), 2.65 (3H, d, J = 5.6 Hz), 2.92 (2H, t-like), 3.57 (2H, t, J = 6.6 Hz), 3.82 (2H, t, J = 5.0 Hz), 3.91 (2H, t-like), 4.19 (2H, t, J = 5.0 Hz), 4.27 (1H, q, J = 5.6 Hz), 6.94 (2H, d, J = 8.8 Hz), 7.03 (2H, d, J = 8.6 Hz), 7.37 (1H, d, J = 8.4 Hz), 7.52 - 7.56 (3H, m), 7.67 (2H, d, J = 9.2 Hz), 7.71 (1H, d, J = 2.2 Hz), 7.86 (1H, s).

IR (KBr) ν: 2595, 2932, 2872, 1682, 1493 cm⁻¹.

Anal. Calcd. for C₃₀H₃₄N₂O₆S: C, 65.43; H, 6.22; N, 5.09. Found C, 65.18; H, 6.01; N, 5.02.

Working Example 49 (Production of Compound 49)

[0307] One droplet of DMF was added to a solution of 1-allyl-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (180mg) in tetrahydrofuran (10ml). Then, thionyl chloride (152mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl N-(tetrahydropyran-4-yl)amino]methyl]aniline (113mg) and triethylamine (516mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate twice. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-allyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 49) (125mg) as yellow crystals.

mp 110.0 - 111.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.6 Hz), 1.59 - 1.80 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.91 (br, 2H), 3.30 - 3.43 (m, 4H), 3.51 (t, 2H, J = 6.8 Hz), 3.57 (s, 2H), 3.80 (t, 2H, J = 4.4 Hz), 3.97 - 4.06 (m, 4H), 4.16 (t, 2H, J = 5.2 Hz), 5.28 (d, 2H, J = 12.8 Hz), 5.95 (br, 1H), 6.89 (d, 1H, J = 8.2 Hz), 6.99 (d, 2H, J = 8.8 Hz), 7.30 (d, 2H, J = 8.4

Hz), 7.37 - 7.56 (m, 8H).

Anal. Calcd. $C_{38}H_{47}N_3O_4$ Calcd. C, 74.18; H, 7.75; N, 6.83. Found C, 73.87; H, 7.95; N, 6.78.

Working Example 50 (Production of Compound 50)

5 **[0308]** In toluene (15ml), ethanol (1.5ml) and water (1.5ml) were suspended 1-allyl-7-bromo-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (262mg), 4-butoxyethoxyphenyl borate (169mg) and potassium carbonate (196mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the mixture was added tetrakis(triphenylphosphine)palladium (45mg), and the mixture was heated
10 under argon atmosphere at 100°C for 6 hours. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 16), which was recrystallized from hexane-ethyl acetate to give
15 1-allyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 50) (46mg) as yellow crystals.
mp 103.0 - 104.0°C
 1H -NMR (200 MHz, $CDCl_3$) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.49 (m, 2H), 1.58 - 1.82 (m, 6 Hz), 2.21 (s, 3H), 2.67 (br, 1H), 2.90 (br, 2H), 3.32 - 3.43 (m, 4H), 3.52 - 3.58 (m, 4H), 3.80 (t, 2H, J = 4.8 Hz), 3.93 - 4.10 (m, 4H), 4.16 (t, 2H, J = 4.6 Hz), 5.29 (d, 2H, J = 14.0 Hz), 5.95 (br, 1H), 6.90 (d, 1H, J = 8.6 Hz), 6.98 (d, 2H, J = 8.8 Hz), 7.30 (d, 2H, J = 8.4 Hz), 7.38 - 7.56 (m, 8H).

Working Example 51 (Production of Compound 51)

25 **[0309]** One droplet of DMF was added to a solution of 1-(2-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (190mg) in tetrahydrofuran (10ml). Then, thionyl chloride (139mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (104mg) and triethylamine (476mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under
30 nitrogen atmosphere at room temperature for 3.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-(2-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-
35 1-benzazepine-4-carboxamide (Compound 51) (169mg) as yellow crystals.
mp 118.0 - 119.0°C
 1H -NMR (200 MHz, $CDCl_3$) δ 0.94 (t, 3H, J = 7.4 Hz), 1.59 - 1.82 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.89 (br, 2H), 3.30 - 3.42 (m, 4H), 3.51 (t, 2H, J = 7.0 Hz), 3.57 (s, 2H), 3.80 (t, 2H, J = 4.4 Hz), 3.89 (s, 3H), 4.04 (d, 2H, J = 11.0 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.59 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.92 - 6.99 (m, 4H), 7.16 (d, 1H, J = 6.6 Hz), 7.28 - 7.35 (m, 4H), 7.43 - 7.56 (m, 7H).
40 Anal. Calcd. $C_{43}H_{51}N_3O_3 \cdot 0.2H_2O$ Calcd. C, 74.47; H, 7.42; N, 6.06. Found C, 74.20; H, 7.53; N, 6.02.

Working Example 52 (Production of Compound 52)

45 **[0310]** One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (230mg) in tetrahydrofuran (10ml). Then, thionyl chloride (164mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml) and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (121mg) and triethylamine (558mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under
50 nitrogen atmosphere at room temperature for 3.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-
55 1-benzazepine-4-carboxamide (Compound 52) (236mg) as yellow crystals.
mp 111.5 - 112.5°C
 1H -NMR (200 MHz, $CDCl_3$) δ 0.93 (t, 3H, J = 7.2 Hz), 1.25 - 1.44 (m, 2H), 1.50 - 1.80 (m, 6H), 2.21 (s, 3H), 2.65 (br,

1H), 2.90 (br, 2H), 3.32 - 3.42 (m, 4H), 3.52 - 3.57 (m, 4H), 3.80 (t, 2H, J = 4.4 Hz), 3.89 (s, 3H), 4.04 (d, 2H, J = 11.8 Hz), 4.15 (t, 2H, J = 5.6 Hz), 4.59 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.92 - 6.99 (m, 4H), 7.16 (d, 1H, J = 6.6 Hz), 7.26 - 7.32 (m, 4H), 7.44 - 7.57 (m, 7H).
 Anal. Calcd. $C_{44}H_{53}N_3O_5 \cdot 0.1H_2O$ Calcd. C, 74.88; H, 7.60; N, 5.96; Found C, 74.62; H, 7.39; N, 5.89.

Working Example 53 (Production of Compound 53)

[0311] One droplet of DMF was added to a solution of 1-(3-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (110mg) in tetrahydrofuran (10ml). Then, thionyl chloride (80mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (60mg) and triethylamine (273mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-(3-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 53) (62mg) as yellow crystals.

mp 113.0 - 114.0°C
¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.2 Hz), 1.56 - 1.80 (m, 6H), 2.21 (s, 3H), 2.62 (br, 1H), 2.86 (br, 2H), 3.32 - 3.45 (m, 4H), 3.51 (t, 2H, J = 6.6 Hz), 3.57 (s, 2H), 3.78 - 3.83 (m, 5H), 4.03 (d, 2H, J = 9.8 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.82 - 6.92 (m, 4H), 6.98 (d, 2H, J = 8.8 Hz), 7.26 - 7.38 (m, 4H), 7.45 - 7.56 (m, 7H).

Working Example 54 (Production of Compound 54)

[0312] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg) in tetrahydrofuran (10ml). Then, thionyl chloride (107mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (79mg) and triethylamine (363mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 54) (29mg) as yellow crystals.

mp 107.5 - 108.5°C
¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.33 - 1.45 (m, 2H), 1.57 - 1.80 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.86 (br, 2H), 3.32 - 3.45 (m, 4H), 3.55 (t, 2H, J = 6.6 Hz), 3.57 (s, 2H), 3.78 - 3.83 (m, 5H), 4.03 (d, 2H, J = 9.4 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.58 (s, 2H), 6.82 - 6.92 (m, 4H), 6.97 (d, 2H, J = 8.8 Hz), 7.26 - 7.39 (m, 4H), 7.44 - 7.55 (m, 7H).
 Anal. Calcd. $C_{44}H_{53}N_3O_5$ Calcd. C, 75.08; H, 7.59; N, 5.97; Found C, 74.74; H, 7.52; N, 5.91.

Working Example 55 (Production of Compound 55)

[0313] One droplet of DMF was added to a solution of 1-(4-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (110mg) in tetrahydrofuran (10ml). Then, thionyl chloride (96mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (71mg) and triethylamine (328mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-(4-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-

benzazepine-4-carboxamide (Compound 55) (86mg) as yellow crystals.

mp 160.0 - 161.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.8 Hz), 1.58 - 1.80 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.81 (br, 2H), 3.32 - 3.42 (m, 4H), 3.51 (t, 2H, J = 6.6 Hz), 3.57 (s, 2H), 3.78 - 3.82 (m, 5H), 4.03 (d, 2H, J = 9.4 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.54 (s, 2H), 6.89 - 7.00 (m, 5H), 7.22 - 7.41 (m, 5H), 7.45 - 7.56 (m, 7H).

Anal. Calcd. C₄₃H₅₁N₃O₅·0.4H₂O Calcd. C, 74.08; H, 7.43; N, 6.03. Found C, 73.82; H, 7.60; N, 5.99.

Working Example 56 (Production of Compound 56)

[0314] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (140mg) in tetrahydrofuran (10ml). Then, thionyl chloride (100mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (74mg) and triethylamine (344mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 3.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(4-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 56) (89mg) as yellow crystals.

mp 151.0 - 152.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.26 - 1.46 (m, 2H), 1.50 - 1.80 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.81 (br, 2H), 3.28 - 3.42 (m, 4H), 3.52 - 3.60 (m, 4H), 3.77 - 3.82 (m, 5H), 4.03 (d, 2H, J = 10.2 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.54 (s, 2H), 6.89 - 7.22 (m, 5H), 7.20 - 7.40 (m, 5H), 7.45 - 7.56 (m, 7H).

Anal. Calcd. C₄₄H₅₃N₃O₅·0.3H₂O Calcd. C, 74.50; H, 7.62; N, 5.93. Found C, 74.34; H, 7.62; N, 5.96.

Working Example 57 (Production of Compound 57)

[0315] One droplet of DMF was added to a solution of 7-(4-propoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (250mg) in tetrahydrofuran (10ml). Then, thionyl chloride (193mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (143mg) and triethylamine (655mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 57) (260mg) as yellow crystals.

mp 131.5 - 132.5°C

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.58 - 1.80 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.84 (br, 2H), 3.32 - 3.42 (m, 4H), 3.51 (t, 2H, J = 7.0 Hz), 3.57 (s, 2H), 3.81 (t, 2H, J = 4.2 Hz), 4.03 (d, 2H, J = 10.6 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.93 - 7.06 (m, 4H), 7.16 (br, 1H), 7.28 - 7.42 (m, 4H), 7.45 - 7.55 (m, 7H).

Anal. Calcd. C₄₀H₄₇N₃O₄·0.1H₂O Calcd. C, 71.95; H, 7.13; N, 6.29. Found C, 71.66; H, 7.12; N, 6.22.

Working Example 58 (Production of Compound 58)

[0316] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (250mg) in tetrahydrofuran (10ml). Then, thionyl chloride (187mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (131mg) and triethylamine (638mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 58) (260mg) as yellow crystals.

matography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 58) (233mg) as yellow crystals.

mp 122.0 - 123.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz); 1.34 - 1.50 (m, 2H), 1.60 - 1.75 (m, 6H), 2.21 (s, 3H), 2.60 (br, 1H), 2.84 (br, 2H), 3.32 - 3.45 (m, 4H), 3.52 - 3.58 (m, 4H), 3.80 (t, 2H, J = 4.0 Hz), 4.05 (d, 2H, J = 12.2 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.58 (s, 2H), 6.93 - 7.06 (m, 4H), 7.16 (br, 1H), 7.32 - 7.42 (m, 4H), 7.45 - 7.55 (m, 7H). Anal. Calcd. C₄₁H₄₉N₃O₄S Calcd. C, 72.43; H, 7.26; N, 6.18. Found C, 72.03; H, 7.44; N, 6.12.

Working Example 59 (Production of Compound 59)

[0317] One droplet of DMF was added to a solution of 7-(4-propoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (240mg) in tetrahydrofuran (10ml). Then, thionyl chloride (184mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour.

The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (137mg) and triethylamine (629mg) in tetrahydrofuran (10ml) at 0°C.

[0318] The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 59) (152mg) as yellow crystals.

mp 104.5 - 105.5°C

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.2 Hz), 1.57 - 1.80 (m, 6H), 2.21 (s, 3H), 2.62 (br, 1H), 2.88 (br, 2H), 3.32 - 3.41 (m, 4H), 3.51 (t, 2H, J = 6.6 Hz), 3.57 (s, 2H), 3.81 (t, 2H, J = 4.8 Hz), 4.04 (d, 2H, J = 11.4 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.73 (s, 2H), 6.96 - 7.05 (m, 5H), 7.26 - 7.32 (m, 3H), 7.40 - 7.60 (m, 8H).

Anal. Calcd. C₄₀H₄₇N₃O₄S Calcd. C, 72.15; H, 7.11; N, 6.31. Found C, 71.87; H, 6.92; N, 6.26.

Working Example 60 (Production of Compound 60)

[0319] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (110mg) in tetrahydrofuran (10ml). Then, thionyl chloride (82mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour.

The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (20ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (61mg) and triethylamine (279mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 3 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate.

The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 60) (86mg) as yellow crystals.

mp 84.0 - 85.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 2H, J = 7.2 Hz), 1.34 - 1.50 (m, 2H), 1.59 - 1.80 (m, 6H), 2.22 (s, 3H), 2.66 (br, 1H), 2.89 (br, 2H), 3.30 - 3.45 (m, 4H), 3.55 (t, 2H, J = 6.6 Hz), 3.58 (s, 2H), 3.80 (t, 2H, J = 4.0 Hz), 4.04 (d, 2H, J = 12.6 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.73 (s, 2H), 6.96 - 7.06 (m, 5H), 7.29 - 7.33 (m, 3H), 7.45 - 7.56 (m, 8H).

Anal. Calcd. C₄₁H₄₉N₃O₄S Calcd. C, 71.29; H, 7.33; N, 6.08. Found C, 71.14; H, 7.12; N, 6.01.

Working Example 61 (Production of Compound 61)

[0320] One droplet of DMF was added to a solution of 1-(3-furylmethyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (159mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour.

The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (118mg) and triethylamine (546mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 4.5 hours, to the mixture was added water, and the mixture was extracted

with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-(3-furylmethyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 61) (153mg) as yellow crystals.

mp 115.0 - 116.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.2 Hz), 1.59 - 1.85 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.85 (br, 2H), 3.32 - 3.43 (m, 4H), 3.51 (t, 2H, J = 6.6 Hz), 3.57 (s, 2H), 3.81 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 14.6 Hz), 4.17 (t, 2H, J = 5.6 Hz), 4.41 (s, 2H), 6.40 (s, 1H), 6.96 - 7.01 (m, 3H), 7.30 (d, 2H, J = 8.8 Hz), 7.43 - 7.56 (m, 10H).

Anal. Calcd. C₄₀H₄₇N₃O₅ Calcd. C, 73.93; H, 7.29; N, 6.47. Found C, 73.53; H, 7.32; N, 6.38.

Working Example 62 (Production of Compound 62)

[0321] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(3-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (155mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (115mg) and triethylamine (526mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 4.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-furylmethyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 62) (125mg) as yellow crystals.

mp 116.0 - 117.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.25 - 1.45 (m, 2H), 1.58 - 1.81 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.84 (br, 2H), 3.32 - 3.43 (m, 4H), 3.56 (t, 2H, J = 7.0 Hz), 3.57 (s, 2H), 3.80 (t, 2H, J = 4.8 Hz), 4.04 (d, 2H, J = 10.6 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.41 (s, 2H), 6.40 (d, 1H, J = 0.8 Hz), 6.96 - 7.01 (m, 3H), 7.30 (d, 2H, J = 8.8 Hz), 7.38 - 7.56 (m, 10H).

Anal. Calcd. C₄₁H₄₉N₃O₅·0.2H₂O Calcd. C, 73.81; H, 7.41; N, 6.30. Found C, 73.71; H, 7.43; N, 6.18.

Working Example 63 (Production of Compound 63)

[0322] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-ethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (138mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (103mg) and triethylamine (476mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-ethoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 63) (161mg) as yellow crystals.

mp 104.5 - 105.5°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.32 - 1.47 (m, 5H), 1.56 - 1.80 (m, 6H), 2.21 (s, 3H), 2.63 (br, 1H), 2.90 (br, 2H), 3.32 - 3.42 (m, 4H), 3.52 - 3.57 (m, 4H), 3.80 (t, 2H, J = 4.8 Hz), 4.01 - 4.18 (m, 6H), 4.60 (s, 2H), 6.84 (d, 1H, J = 8.8 Hz), 6.89 - 6.99 (m, 5H), 7.16 (d, 1H, J = 6.2 Hz), 7.27 - 7.37 (m, 4H), 7.44 - 7.56 (m, 6H). Anal. Calcd. C₄₅H₅₅N₃O₅ Calcd. C, 75.28; H, 7.72; N, 5.85. Found C, 74.94; H, 7.77; N, 5.67.

Working Example 64 (Production of Compound 64)

[0323] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (134mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended

in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (100mg) and triethylamine (455mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature for 4.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 64) (207mg) as yellow crystals.

mp 114.5 - 115.5°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.02 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.57 - 1.85 (m, 8H), 2.21 (s, 3H), 2.63 (br, 1H), 2.86 (br, 2H), 3.30 - 3.46 (m, 4H), 3.52 - 3.59 (m, 4H), 3.80 (t, 2H, J = 4.0 Hz), 3.91 (t, 2H, J = 6.6 Hz), 4.04 (d, 2H, J = 10.4 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.57 (s, 2H), 6.85 - 7.00 (m, 6H), 7.26 - 7.40 (m, 4H), 7.45 - 7.56 (m, 7H).

Anal. Calcd. C₄₆H₅₇N₃O₅ Calcd. C, 75.48; H, 7.85; N, 5.74.

Found C, 75.21; H, 7.85; N, 5.64.

Working Example 65 (Production of Compound 65)

[0324] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2,5-dimethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (134mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (100mg) and triethylamine (455mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2,5-dimethoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 65) (210mg) as yellow crystals.

mp 143.0 - 144.0°C

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.32 - 1.45 (m, 2H), 1.56 - 1.80 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.90 (br, 2H), 3.32 - 3.47 (m, 4H), 3.55 (t, 2H, J = 2.0 Hz), 3.57 (s, 2H), 3.71 (s, 3H), 3.80 (t, 2H, J = 4.0 Hz), 3.84 (s, 3H), 4.04 (d, 2H, J = 14.2 Hz), 4.16 (t, 2H, J = 5.6 Hz), 4.56 (s, 2H), 6.76 - 6.89 (m, 4H), 6.97 (d, 2H, J = 8.8 Hz), 7.26 - 7.36 (m, 3H), 7.44 - 7.56 (m, 7H).

Anal. Calcd. C₄₅H₅₅N₃O₆ Calcd. C, 73.64; H, 7.55; N, 5.73. Found C, 73.37; H, 7.63; N, 5.66.

Working Example 66 (Production of Compound 66)

[0325] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-fluorobenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (146mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. The solvent and excess thionyl chloride were evaporated under reduced pressure, the resulting residue was suspended in tetrahydrofuran (30ml), and the suspension was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (108mg) and triethylamine (496mg) in tetrahydrofuran (10ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8) to give 7-(4-butoxyethoxyphenyl)-1-(2-fluorobenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 66) (139mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.30 - 1.50 (m, 2H), 1.51 - 1.82 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.88 (br, 2H), 3.30 - 3.45 (m, 4H), 3.50 - 3.62 (m, 4H), 3.80 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 11.0 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.65 (s, 2H), 6.86 (d, 1H, J = 8.6 Hz), 6.98 (d, 2H, J = 8.8 Hz), 7.07 - 7.16 (m, 2H), 7.20 - 7.60 (m, 12H).

Anal. Calcd. C₄₃H₅₀N₃O₄·0.8H₂O Calcd. C, 73.13; H, 7.14; N, 5.95. Found, C, 72.93; H, 7.22; N, 5.79.

Working Example 67 (Production of Compound 67)

[0326] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(1-methylimidazol-2-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (140mg) in tetrahydrofuran (10ml). Then, thionyl chloride (41mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this mixture was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (75mg) and triethylamine (346mg) in tetrahydrofuran (30ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with basic silica gel column chromatography (ethyl acetate), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylimidazol-2-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 67) (65mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.30 - 1.45 (m, 2H), 1.55 - 1.80 (m, 6H), 2.20 (s, 3H), 2.51 (br, 2H), 2.64 (br, 1H), 3.30 - 3.45 (m, 4H), 3.52 - 3.59 (m, 5H), 3.81 (t, 2H, J = 4.8 Hz), 4.04 (d, 2H, J = 10.2 Hz), 4.17 (t, 2H, J = 5.2 Hz), 4.62 (s, 2H), 4.79 (s, 2H), 6.90 (d, 1H, J = 1.2 Hz), 6.97 - 7.01 (m, 3H), 7.07 (d, 1H, J = 8.0 Hz), 7.27 - 7.32 (m, 2H), 7.46 - 7.57 (m, 8H).

Working Example 68 (Production of Compound 68)

[0327] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(thiazol-2-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (70mg) in dichloromethane (10ml). Then, thionyl chloride (23mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (42mg) and triethylamine (385mg) in dichloromethane (20ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-2-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 68) (66mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.33 - 1.45 (m, 2H), 1.58 - 1.80 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.95 (br, 2H), 3.30 - 3.57 (m, 8H), 3.80 (t, 2H, J = 4.0 Hz), 4.04 (d, 2H, J = 10.4 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.88 (s, 2H), 6.96 - 7.03 (m, 3H), 7.26 - 7.60 (m, 8H), 7.80 (d, 1H, J = 3.2 Hz).

Anal. Calcd. C₄₀H₄₈N₄O₄S Calcd. C, 70.56; H, 7.11; N, 8.23. Found C, 70.38; H, 7.12; N, 8.18.

Working Example 69 (Production of Compound 69)

[0328] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (380mg) in dichloromethane (20ml). Then, thionyl chloride (124mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (229mg) and triethylamine (2.1g) in dichloromethane (30ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 69) (338mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.80 (m, 6H), 2.21 (s, 3H), 2.63 (br, 1H), 2.85 (br, 2H), 3.28 - 3.45 (m, 4H), 3.52 - 3.59 (m, 4H), 3.80 (t, 2H, J = 4.0 Hz), 3.90 (s, 3H), 4.04 (d, 2H, J = 11.6 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.44 (s, 2H), 6.96-7.01 (m, 3H), 7.15 - 7.22 (m, 3H), 7.26 - 7.39 (m, 3H), 7.45 - 7.55 (m, 9H). Anal. Calcd. C₄₁H₅₁N₅O₄ Calcd. C, 72.64; H, 7.58; N, 10.33. Found C, 72.34; H, 7.59; N, 10.34.

Working Example 70 (Production of Compound 70)

[0329] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (150mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere.

phere for 1 hour. Then, this mixture was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (111mg) and triethylamine (1.0g) in tetrahydrofuran (25ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with basic silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 70) (60mg) as yellow amorphous. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34-1.45 (m, 2H), 1.50 - 1.80 (m, 6H), 2.21 (s, 3H), 2.40-2.70 (m, 3H), 3.30 - 3.45 (m, 4H), 3.52 - 3.59 (m, 4H), 3.79 - 3.84 (m, 5H), 4.04 (d, 2H, J = 10.6 Hz), 4.17 (t, 2H, J = 5.2 Hz), 4.55 (s, 2H), 6.25 (d, 1H, J = 1.8 Hz), 6.93 - 7.02 (m, 3H), 7.30 (d, 2H, J = 8.4 Hz), 7.42 - 7.57 (m, 9H). Anal. Calcd. C₄₁H₅₂N₅O₄·0.2H₂O Calcd. C, 72.26; H, 7.60; N, 10.28. Found C, 72.02; H, 7.46; N, 10.03.

Working Example 71 (Production of Compound 71)

[0330] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(3,5-dimethylisoxazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (140mg) in tetrahydrofuran (10ml). Then, thionyl chloride (102mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this mixture was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (75mg) and triethylamine (690mg) in tetrahydrofuran (25ml) at 0°C. The suspension was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-1-[(3,5-dimethylisoxazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 71) (45mg) as yellow amorphous. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.33 - 1.45 (m, 2H), 1.50 - 1.80 (m, 6H), 2.22 (s, 6H), 2.41 (s, 3H), 2.67 (br, 2H), 3.20 (br, 2H), 3.30 - 3.44 (m, 2H), 3.52 - 3.59 (m, 4H), 3.81 (t, 2H, J = 4.8 Hz), 4.04 (d, 2H, J = 9.2 Hz), 4.17 (t, 2H, J = 5.4 Hz), 4.29 (s, 2H), 6.95 - 7.02 (m, 3H), 7.31 (d, 2H, J = 8.4 Hz), 7.42 - 7.57 (m, 8H). Anal. Calcd. C₄₂H₅₂N₄O₅·0.2H₂O Calcd. C, 72.42; H, 7.52; N, 8.04. Found C, 72.15; H, 7.72; N, 7.81.

Working Example 72 (Production of Compound 72)

[0331] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (200mg) in tetrahydrofuran (10ml). Then, thionyl chloride (155mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, the solvent and excess thionyl chloride were evaporated, and the resulting residue was suspended in tetrahydrofuran (15ml) and added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (115mg) and triethylamine (1.1g) in tetrahydrofuran (10ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature for 2.5 hours, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-furylmethyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 72) (199mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.37 - 1.48 (m, 2H), 1.58 - 1.80 (m, 6H), 2.22 (s, 3H), 2.65 (br, 1H), 2.85 (br, 2H), 3.27 - 3.46 (m, 4H), 3.52 - 3.57 (m, 4H), 3.81 (t, 2H, J = 4.6 Hz), 4.03 (d, 2H, J = 11.8 Hz), 4.16 (t, 2H, J = 4.8 Hz), 4.51 (s, 2H), 6.29 (d, 1H, J = 3.2 Hz), 6.38 (dd, 1H, J = 2.8, 1.8 Hz), 6.98 (d, 2H, J = 8.8 Hz), 7.09 (d, 1H, J = 8.8 Hz), 7.31 (d, 2H, J = 8.6 Hz), 7.40 - 7.56 (m, 9H). Anal. Calcd. C₄₁H₄₉N₃O₅·0.1H₂O Calcd. C, 73.97; H, 7.42; N, 6.31. Found C, 73.77; H, 7.24; N, 6.28.

Working Example 73 (Production of Compound 73)

[0332] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-pyridylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (50mg) in dichloromethane (5ml). Then, thionyl chloride (17mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (31mg) and triethylamine (287mg) in dichloromethane (15ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic

layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(2-pyridylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 73) (31mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.30 - 1.44 (m, 2H), 1.52 - 1.82 (m, 6H), 2.22 (s, 3H), 2.65 (br, 1H), 2.93 (br, 2H), 3.30 - 3.58 (m, 8H), 3.80 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 10.6 Hz), 4.15 (t, 2H, J = 5.2 Hz), 4.73 (s, 2H), 6.85 (d, 1H, J = 8.6 Hz), 6.97 (d, 2H, J = 8.6 Hz), 7.20 - 7.37 (m, 5H), 7.44 - 7.71 (m, 8H), 8.65 (d, 1H, J = 5.2 Hz).

Working Example 74 (Production of Compound 74)

[0333] To a solution of 7-(4-butoxyethoxyphenyl)-N-[4-[[methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (150mg) and 1-methylpyrrol-2-carboxyaldehyde (140mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (326mg). The mixture was stirred under nitrogen atmosphere at room temperature for 4 days and, then, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 6) to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrrol-2-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 74) (8mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.30 - 1.49 (m, 2H), 1.54 - 1.85 (m, 6H), 2.21 (s, 3H), 2.50 (br, 2H), 2.65 (br, 1H), 3.25 - 3.59 (m, 11H), 3.81 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 11.8 Hz), 4.17 (t, 2H, J = 5.2 Hz), 4.47 (s, 2H), 6.11 (t, 1H, J = 2.8 Hz), 6.16 (s, 1H), 6.66 (s, 1H), 6.97 - 7.06 (m, 3H), 7.29 (d, 2H, J = 9.8 Hz), 7.46 - 7.56 (m, 8H).

Working Example 75 (Production of Compound 75)

[0334] To a solution of 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (130mg) and 2-methylloxazol-4-carboxyaldehyde (100mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (378mg). The mixture was stirred under nitrogen atmosphere at room temperature for 5 days and, then, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with basic silica gel column chromatography (hexane : ethyl acetate = 1 : 2) to give 7-(4-butoxyethoxyphenyl)-1-[(2-methylloxazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 75) (29mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.54 - 1.80 (m, 6H), 2.21 (s, 3H), 2.48 (s, 3H), 2.63 (br, 1H), 2.90 (br, 2H), 3.30 - 3.45 (m, 4H), 3.52 - 3.58 (m, 4H), 3.80 (t, 2H, J = 4.6 Hz), 4.04 (d, 2H, J = 11.4 Hz), 4.16 (t, 2H, J = 4.4 Hz), 4.43 (s, 2H), 6.96 - 7.05 (m, 3H), 7.30 (d, 2H, J = 8.4 Hz), 7.38 - 7.55 (m, 9H).

Working Example 76 (Production of Compound 76)

[0335] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(2-methylthiazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg) in chloroform (10ml). Then, thionyl chloride (47mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (87mg) and triethylamine (800mg) in chloroform (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-1-[(2-methylthiazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 76) (37mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.82 (m, 6H), 2.22 (s, 3H), 2.66 (br, 1H), 2.74 (s, 3H), 2.91 (br, 2H), 3.30 - 3.48 (m, 4H), 3.52 - 3.58 (m, 4H), 3.80 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 11.4 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.67 (s, 2H), 6.92 - 7.00 (m, 4H), 7.26 - 7.60 (m, 10H).

Working Example 77 (Production of Compound 77)

[0336] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(3-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg) in dichloromethane (10ml). Then, thionyl chloride (47mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere.

phere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (87mg) and triethylamine (800mg) in dichloromethane (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(3-methylisothiazol-5-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 77) (96mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 6.8 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.80 (m, 6H), 2.21 (s, 3H), 2.49 (s, 3H), 2.64 (br, 1H), 2.94 (br, 2H), 3.31 - 3.41 (m, 4H), 3.52 - 3.58 (m, 4H), 3.80 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 10.2 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.79 (s, 2H), 6.90 - 7.01 (m, 4H), 7.31 (d, 2H, J = 8.8 Hz), 7.38 - 7.56 (m, 8H).

Anal. Calcd. C₄₁H₅₀N₄O₄S Calcd. C, 70.86; H, 7.25; N, 8.06. Found C, 70.57; H, 7.01; N, 8.02.

Working Example 78 (Production of Compound 78)

[0337] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (100mg) in dichloromethane (10ml). Then, thionyl chloride (31mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (57mg) and triethylamine (520mg) in dichloromethane (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 78) (43mg) as colorless crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.81 (m, 6H), 2.21 (s, 3H), 2.62 (br, 1H), 3.10 (br, 2H), 3.37 (td, 2H, J = 10.6, 2.8 Hz), 3.53-3.59 (m, 4H), 3.82 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 12.6 Hz), 4.18 (t, 2H, J = 5.0 Hz), 6.80 - 6.83 (m, 2H), 7.02 (d, 2H, J = 8.8 Hz), 7.12 (d, 1H, J = 8.0 Hz), 7.29 - 7.41 (m, 4H), 7.51 - 7.60 (m, 6H), 7.74 (d, 1H, J = 2.2, Hz).

Anal. Calcd. C₄₁H₄₇N₃O₅S·0.2H₂O Calcd. C, 70.60; H, 6.85; N, 6.02. Found C, 70.46; H, 6.89; N, 5.97.

Working Example 79 (Production of Compound 79)

[0338] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg) in dichloromethane (10ml). Then, thionyl chloride (47mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (88mg) and triethylamine (805mg) in dichloromethane (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 79) (99mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.85 (m, 11H), 2.21 (s, 3H), 2.64 (br, 1H), 2.84 (br, 2H), 3.29 - 3.46 (m, 4H), 3.52 - 3.59 (m, 4H), 3.80 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 9.4 Hz), 4.11 - 4.18 (m, 4H), 4.44 (s, 2H), 6.96 - 7.01 (m, 3H), 7.28 - 7.36 (m, 3H), 7.40 - 7.56 (m, 9H).

Anal. Calcd. C₄₂H₅₃N₅O₄ Calcd. C, 72.91; H, 7.72; N, 10.12. Found C, 72.69; H, 8.00; N, 9.92.

Working Example 80 (Production of Compound 80)

[0339] One droplet of DMF was added to a solution of 2-methyldioxolane-2-ylacetic acid in tetrahydrofuran (10ml). Then, thionyl chloride (80mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. This solution was added to a solution of 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (100mg) and pyridine (528mg) in tetrahydrofuran (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, the insolubles were filtered off using Celite, to the mixture was added water, and the mixture

was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[2-(2-methyl-1,3-dioxolan-2-yl)acetyl]-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 80) (60mg) as colorless crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.0 Hz), 1.34 - 1.85 (m, 11H), 2.21 (s, 3H), 2.50 - 3.05 (m, 5H), 3.20 (d, 1H, J = 13.6 Hz), 3.38 (td, 2H, J = 10.8, 3.6 Hz), 3.53 - 3.70 (m, 5H), 3.75 - 3.95 (m, 5H), 4.04 (d, 2H, J = 10.2 Hz), 4.18 (t, 2H, J = 5.4 Hz), 4.90 (d, 1H, J = 13.2 Hz), 7.03 (d, 2H, J = 9.2 Hz), 7.29 - 7.35 (m, 3H), 7.51 - 7.67 (m, 8H). Anal. Calcd. C₄₂H₅₃N₃O₇·0.1H₂O Calcd. C, 70.68; H, 7.51; N, 5.89. Found C, 70.41; H, 7.33; N, 5.89.

Working Example 81 (Production of Compound 81)

[0340] A catalytic amount of N,N-dimethyl-4-aminopyridine was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(4-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg), 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (88mg) and 1-hydroxybenzotriazole (96mg) in DMF (15ml), followed by addition of 1-ethyl-3-(3-dimethylaminopropylcarbodiimide) (137mg). The mixture was stirred under nitrogen atmosphere at room temperature overnight. To the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3) to give 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-1-[(4-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 81) (7mg) as yellow amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.47 (m, 2H), 1.51 - 1.80 (m, 6H), 2.21 (s, 3H), 2.52 (s, 3H), 2.63 (br, 1H), 2.84 (br, 2H), 3.33 - 3.42 (m, 4H), 3.52 - 3.59 (m, 4H), 3.81 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 12.2 Hz), 4.16 (t, 2H, J = 4.8 Hz), 4.67 (s, 2H), 6.95 (d, 1H, J = 6.2 Hz), 6.99 (d, 2H, J = 7.0 Hz), 7.30 (d, 2H, J = 8.8 Hz), 7.40 - 7.56 (m, 8H), 8.68 (s, 1H).

Working Example 82 (Production of Compound 82)

[0341] One droplet of DMF was added to a solution of 7-(4-butoxyethoxyphenyl)-1-[(1-isopropylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (150mg) in dichloromethane (10ml). Then, thionyl chloride (49mg) was added at 0°C, the temperature was returned to room temperature, and the mixture was stirred under nitrogen atmosphere for 1 hour. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (90mg) and triethylamine (830mg) in dichloromethane (20ml) at 0°C. The mixture was stirred under nitrogen atmosphere at room temperature overnight, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 3), which was recrystallized to give 7-(4-butoxyethoxyphenyl)-1-[(1-isopropylpyrazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 82) (119mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.85 (m, 14H), 2.21 (s, 3H), 2.65 (br, 1H), 2.84 (br, 2H), 3.36 - 3.52 (m, 4H), 3.56 - 3.59 (m, 4H), 3.81 (t, 2H, J = 4.4 Hz), 4.04 (d, 2H, J = 11.8 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.44 - 4.52 (m, 3H), 6.96 - 7.02 (m, 3H), 7.30 (d, 2H, J = 8.6 Hz), 7.39 - 7.56 (m, 10H).

Anal. Calcd. C₄₃H₅₅N₅O₄ Calcd. C, 73.16; H, 7.85; N, 9.92. Found C, 72.99; H, 7.76; N, 9.75.

Reference Example 147

[0342] To a suspension of 60% sodium hydride (0.17g) in DMF (5ml) which had been washed with hexane three times was added dropwise a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (1.0g) in DMF (10ml) at 0°C under nitrogen atmosphere. The temperature was returned to room temperature and the mixture was stirred for 1 hour. Then, a solution of allyl bromide (0.56g) in DMF (5ml) was added dropwise thereto at 0°C, the temperature was returned to room temperature, and the mixture was stirred at room temperature overnight. To the mixture were added ethyl acetate and water, and the mixture was separated. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 7 : 1) to give methyl 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (0.38g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.79 (t, 2H, J = 5.4 Hz), 3.22 (t, 2H, J = 5.2 Hz), 3.80 (s, 3H), 3.89 (d, 2H, J = 4.8 Hz), 5.16 - 5.28 (m, 2H), 5.81 - 5.97 (m, 1H), 6.58 (d, 1H, J = 8.8 Hz), 7.23 (dd, 1H, J = 8.8, 2.6 Hz), 7.4 (d, 1H, J = 2.6 Hz),

7.59 (s, 1H).

Reference Example 148

- 5 [0343] In toluene (20ml), ethanol (2ml) and water (2ml) were suspended methyl 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (274mg), 4-propoxyethoxyphenyl borate (248mg) and potassium carbonate (307mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, tetrakis(triphenyl)phosphinepalladium (69mg) was added thereto, and the mixture was heated under argon atmosphere at 100°C for 8 hours. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated
10 brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 4 : 1) to give methyl 1-allyl-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (269mg) as yellow oil.
- ¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.8 Hz); 1.58 - 1.75 (m, 2H), 2.81 (t, 2H, J = 5.6 Hz), 3.27 (t, 2H, J = 4.4 Hz), 3.51 (t, 2H, J = 6.6 Hz), 3.75 - 3.83 (m, 5H), 3.96 (d, 2H, J = 5.2 Hz), 4.16 (t, 2H, J = 4.8 Hz), 5.23 - 5.30 (m, 2H),
15 5.88 - 6.02 (m, 1H), 6.87 (d, 1H, J = 8.8 Hz), 6.97 (d, 2H, J = 8.4 Hz), 7.39 (dd, 1H, J = 8.8, 2.2 Hz), 7.46 (d, 2H, J = 8.4 Hz), 7.52 (d, 1H, J = 2.2 Hz), 7.78 (s, 1H).

Reference Example 149

- 20 [0344] To a solution of methyl 1-allyl-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (262mg) in a mixture of tetrahydrofuran (19ml) and methanol (19ml) was added 1N sodium hydroxide solution (6.3ml), and the mixture was stirred at room temperature overnight. Then, water and 1N hydrochloric acid were added to make acidic (pH = 4) at 0°C, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give the solid, which was washed with hexane to give 1-allyl-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (199mg) as yellow crystals.
25 mp 152.0 - 153.0°C
- ¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.56 - 1.74 (m, 2H), 3.00 (t, 2H, J = 5.2 Hz), 3.30 (t, 2H, J = 5.2 Hz), 3.51 (t, 2H, J = 6.4 Hz), 3.81 (t, 2H, J = 5.0 Hz), 3.97 (d, 2H, J = 5.2 Hz), 4.16 (t, 2H, J = 4.8 Hz), 5.24 - 5.30 (m, 2H), 5.89 - 6.10 (m, 1H), 6.88 (d, 1H, J = 8.4 Hz), 6.98 (d, 2H, J = 8.4 Hz), 7.40 - 7.49 (m, 3H), 7.53 (d, 1H, J = 2.6 Hz), 7.88 (s, 1H).
30 Anal. Calcd. C₂₅H₂₉NO₄·0.1H₂O Calcd. C, 73.36; H, 7.19; N, 3.42. Found C, 73.11; H, 7.09; N, 3.25.

Reference Example 150

- 35 [0345] To a suspension of 60% sodium hydride (0.23g) in tetrahydrofuran (5ml) which had been washed with hexane three times was added dropwise a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (0.80g) in tetrahydrofuran (10ml) at 0°C under nitrogen atmosphere. The temperature was returned to room temperature and the mixture was stirred for 30 minutes. Then, a solution of allyl bromide (5.12g) in tetrahydrofuran (5ml) was added dropwise
40 thereto at 0°C, and the mixture was stirred at 60°C for 5 days. To the mixture were added ethyl acetate and water, and the mixture was separated. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 5 : 1) to give allyl 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (0.22g) as yellow oil. ¹H-NMR (200 MHz, CDCl₃) δ 2.81 (t, 2H, J = 5.8 Hz), 3.23 (t, 2H, J = 5.2 Hz), 3.90 (d, 2H, J = 4.8 Hz), 4.69 - 4.73 (m, 2H), 5.11 - 5.42 (m, 4H), 5.81 - 6.07 (m, 2H), 6.68 (d, 1H, J = 9.2 Hz), 7.23 (dd, 1H, J = 8.8, 2.2 Hz),
45 7.43 (d, 1H, J = 2.4 Hz), 7.62 (s, 1H).

Reference Example 151

- 50 [0346] To a solution of allyl 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (224mg) in tetrahydrofuran (10ml) were added tetrakis(triphenyl)phosphinepalladium (74mg) and morpholine (560mg), and the mixture was stirred under argon atmosphere at room temperature for 2 hours. To the mixture was added water at 0°C, and the mixture was made acidic (pH = 4) with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with 1N hydrochloric acid, further with water and saturated brine and dried with magnesium sulfate. The solvent was
55 evaporated under reduced pressure to give 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylic acid (198mg) as yellow amorphous.
- ¹H-NMR (200 MHz, CDCl₃) δ 2.80 (t, 2H, J = 4.2 Hz), 3.23 (t, 2H, J = 4.8 Hz), 3.91 (d, 2H, J = 4.8 Hz), 5.17 - 5.28 (m, 2H), 5.84 - 5.98 (m, 1H), 6.69 (d, 1H, J = 9.2 Hz), 7.24 (dd, 1H, J = 8.8, 2.2 Hz), 7.43 - 7.73 (m, 2H).

Reference Example 152

[0347] 1-allyl-7-bromo-2,3-dihydro-1-benzazepine-4-carboxylic acid (320mg) was dissolved in tetrahydrofuran (15 ml), and DMF (0.3ml) was added to the solution. Then, thionyl chloride (0.23ml) was added thereto at 0°C, and the mixture was stirred under nitrogen atmosphere at room temperature for 2 hours. The solvent and excess thionyl chloride were evaporated under reduced pressure, and the resulting residue was suspended in tetrahydrofuran (25ml), and the suspension was added to a solution of 4-[(N-methyl-N-(tetrahydropyran-4-yl)amino)methyl]aniline (275mg) and triethylamine (1.27g) in tetrahydrofuran (10ml) at 0°C. The temperature was returned to room temperature, and the mixture was stirred overnight. To the mixture was added water, and the mixture was extracted with ethyl acetate twice. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8) to give 1-allyl-7-bromo-N-[4-[(N-methyl-N-(tetrahydropyran-4-yl)amino)methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (266mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.75 (br, 4H), 2.21 (s, 3H), 2.65 (br, 1H), 2.88 (t, 2H, J = 4.4 Hz), 3.29 (t, 2H, J = 5.0 Hz), 3.37 (dt, 2H, J = 8.2, 2.4 Hz), 3.57 (s, 2H), 3.92 (d, 2H, J = 4.8 Hz), 4.04 (d, 2H, J = 11.8 Hz), 5.20 - 5.30 (m, 2H), 5.85 - 5.96 (m, 1H), 6.72 (d, 1H, J = 9.2 Hz), 7.22-7.32 (m, 3H), 7.42 - 7.54 (m, 4H).

Reference Example 153

[0348] To a solution of methyl 7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2-methoxybenzaldehyde (535mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (749mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added thereto and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 1-(2-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (394mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.6 Hz), 1.58 - 1.70 (m, 2H), 2.82 (br, 2H), 3.35 (br, 2H), 3.51 (t, 2H, J = 6.6 Hz), 3.78 - 3.94 (m, 8H), 4.16 (t, 2H, J = 4.6 Hz), 4.57 (s, 2H), 6.78 (d, 1H, J = 9.2 Hz), 6.88 - 6.99 (m, 4H), 7.15 (d, 1H, J = 8.0 Hz), 7.26 - 7.44 (m, 2H), 7.46 (d, 2H, J = 8.4 Hz), 7.55 (d, 1H, J = 2.4 Hz), 7.84 (s, 1H).

Reference Example 154

[0349] To a solution of methyl 1-(2-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (394mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 1-(2-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (217mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.2 Hz), 1.59 - 1.70 (m, 2H), 2.84 (br, 2H), 3.37 (br, 2H), 3.51 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.8 Hz), 3.89 (s, 3H), 4.16 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.80 (d, 1H, J = 8.8 Hz), 6.91 - 7.00 (m, 4H), 7.14 (d, 1H, J = 6.6 Hz), 7.29 - 7.36 (m, 2H), 7.46 (d, 2H, J = 8.8 Hz), 7.55 (d, 1H, J = 2.4 Hz), 7.94 (s, 1H).

Anal. Calcd. C₃₀H₃₃NO₅ Calcd. C, 73.90; H, 6.82; N, 2.87. Found C, 73.58; H, 6.66; N, 2.76.

Reference Example 155

[0350] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2-methoxybenzaldehyde (517mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (724mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (391mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.37 - 1.45 (m, 2H), 1.55 - 1.64 (m, 2H), 2.82 (br, 2H), 3.35 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.82 (m, 5H), 3.88 (s, 3H), 4.16 (t, 2H, J = 5.6 Hz), 4.57 (s, 2H), 6.78 (d, 1H, J = 8.4 Hz), 6.91 - 6.99 (m, 4H), 7.14 (d, 1H, J = 6.4 Hz), 7.26 - 7.40 (m, 2H), 7.46 (d, 2H, J = 8.8 Hz), 7.54 (d, 1H, J = 2.4 Hz), 7.84 (s, 1H).

Reference Example 156

[0351] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (391mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (257mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.45 (m, 2H), 1.57 - 1.64 (m, 2H), 2.84 (br, 2H), 3.36 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.8 Hz), 3.88 (s, 3H), 4.15 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.79 (d, 1H, J = 9.2 Hz), 6.91 - 6.99 (m, 4H), 7.14 (d, 1H, J = 7.4 Hz), 7.29 - 7.36 (m, 2H), 7.46 (d, 2H, J = 8.8 Hz), 7.55 (d, 1H, J = 2.4 Hz), 7.94 (s, 1H).

Anal. Calcd. C₃₁H₃₅NO₅ Calcd. C, 74.23; H, 7.03; N, 2.79.

Found C, 73.96; H, 6.91; N, 2.75.

Reference Example 157

[0352] To a suspension of 60% sodium hydride (0.23g) in tetrahydrofuran (5ml) which had been washed with hexane three times was added dropwise a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (0.80g) in tetrahydrofuran (10ml) under nitrogen atmosphere at 0°C. The temperature was returned to room temperature and the mixture was stirred for 1 hour. Then, to the mixture was added dropwise a solution of 3-methoxybenzyl bromide (2.29g) in tetrahydrofuran (5ml) at 0°C. The temperature was returned to room temperature, and the mixture was stirred for 3 days. To the mixture were added ethyl acetate and water, and the mixture was separated. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 5 : 1) to give methyl 7-bromo-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.69g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.76 (t, 2H, J = 5.8 Hz), 3.26 (t, 2H, J = 3.8 Hz), 3.79 - 3.81 (m, 6H), 4.49 (s, 2H), 6.67 (d, 1H, J = 8.8 Hz), 6.78 - 6.93 (m, 3H), 7.17 - 7.31 (m, 2H), 7.46 (d, 1H, J = 2.2 Hz), 7.63 (z, 1H).

Reference Example 158

[0353] To a solution of methyl 7-bromo-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (691mg) in a mixture of tetrahydrofuran (50ml) and methanol (50ml) was added 1N sodium hydroxide solution (17ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-bromo-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (369mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 2.78 (t, 2H, J = 5.6 Hz), 3.29 (t, 2H, J = 5.6 Hz), 3.79 (s, 3H), 4.51 (s, 2H), 6.68 (d, 1H, J = 9.2 Hz), 6.78 - 6.84 (m, 3H), 7.20 - 7.32 (m, 2H), 7.48 (d, 1H, J = 2.6 Hz), 7.73 (s, 1H).

Anal. Calcd. C₁₉H₁₈NO₃Br Calcd. C, 58.78; H, 4.67; N, 3.61. Found C, 58.81; H, 4.68; N, 3.61.

Reference Example 159

[0354] In toluene (20ml), ethanol (2ml) and water (2ml) were suspended 7-bromo-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (300mg), 4-propoxyethoxyphenyl borate (346mg) and potassium carbonate (534mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (62mg), and the mixture was heated at 100°C for 6 hours under argon atmosphere. After allowing to cool, water was added to the mixture, which was made acidic (pH=4) with 1N hydrochloric acid and extracted with ethyl acetate twice. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 1) and the resulting solid was recrystallized from hexane-ethyl acetate to give 1-(3-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (118mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.60 - 1.70 (m, 2H), 2.81 (br, 2H), 3.34 (br, 2H), 3.51 (t, 2H, J = 7.0 Hz), 3.80 - 3.84 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.58 (s, 2H), 6.85 - 6.90 (m, 4H), 6.98 (d, 2H, J = 8.8 Hz), 7.26 - 7.45 (m, 2H), 7.47 (d, 2H, J = 8.4 Hz), 7.56 (d, 1H, J = 2.4 Hz), 7.93 (s, 1H).

Reference Example 160

[0355] In toluene (15ml), ethanol (1.5ml) and water (1.5ml) were suspended 7-bromo-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (320mg), 4-butoxyethoxyphenyl borate (246mg) and potassium carbonate (285mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (64mg), and the mixture was heated at 100°C for 8 hours under argon atmosphere. After allowing to cool, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 5 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (207mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.30 - 1.50 (m, 2H), 1.55 - 1.65 (m, 2H), 2.78 (t, 2H, J = 4.8 Hz), 3.31 (t, 2H, J = 4.8 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.82 (m, 8H), 4.16 (t, 2H, J = 5.0 Hz), 4.56 (s, 2H), 6.77 - 6.90 (m, 4H), 6.97 (d, 2H, J = 8.6 Hz), 7.24 - 7.29 (m, 1H), 7.36 (dd, 1H, J = 8.4, 2.2 Hz), 7.46 (d, 2H, J = 9.2 Hz), 7.55 (d, 1H, J = 2.2 Hz), 7.82 (s, 1H).

Reference Example 161

[0356] To a solution of 7-bromo-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (202mg) in a mixture of tetrahydrofuran (13ml) and methanol (13ml) was added 1N sodium hydroxide solution (4ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (161mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.54 - 1.65 (m, 2H), 2.81 (br, 2H), 3.34 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.82 - 6.90 (m, 4H), 6.98 (d, 2H, J = 8.8 Hz), 7.29 - 7.41 (m, 2H), 7.46 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 2.4 Hz), 7.93 (s, 1H).

Reference Example 162

[0357] To a suspension of 60% sodium hydride (0.16g) in DMF (5ml) which had been washed with hexane three times was added dropwise a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (1.00g) in DMF (10ml) under nitrogen atmosphere at 0°C. The temperature was returned to room temperature and the mixture was stirred for 1 hour. Then, to the mixture was added dropwise a solution of 4-methoxybenzyl bromide (0.67g) in DMF (5ml) at 0°C. To the mixture was added sodium iodide (0.83g), and the mixture was heated at 60°C overnight. To the mixture were added ethyl acetate and water, and the mixture was separated. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 5 : 1) to give methyl 7-bromo-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.92g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.72 (t, 2H, J = 4.4 Hz), 3.23 (t, 2H, J = 5.0 Hz), 3.80 - 3.82 (m, 6H), 4.46 (s, 2H), 6.70 (d, 1H, J = 4.6 Hz), 6.90 (d, 2H, J = 8.4 Hz), 7.22 - 7.29 (m, 1H), 7.46 (d, 1H, J = 2.2 Hz), 7.62 (s, 1H).

Reference Example 163

[0358] To a solution of methyl 7-bromo-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (920mg) in a mixture of tetrahydrofuran (70ml) and methanol (70ml) was added 1N sodium hydroxide solution (23ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-bromo-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (644mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 2.74 (t, 2H, J = 4.4 Hz), 3.26 (t, 2H, J = 4.4 Hz), 3.82 (s, 3H), 4.48 (s, 2H), 6.71 (d, 1H, J = 8.8 Hz), 6.89 (s, 2H), 7.16 (d, 2H, J = 8.4 Hz), 7.23 (dd, 1H, J = 8.8, 2.6 Hz), 7.48 (d, 1H, J = 2.6 Hz), 7.73 (s, 1H).

Anal. Calcd. C₁₉H₁₈NO₃Br Calcd. C, 58.78; H, 4.67; N, 3.61. Found C, 58.60; H, 4.61; N, 3.57.

Reference Example 164

[0359] In toluene (20ml), ethanol (2ml) and water (2ml) were suspended 7-bromo-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (300mg), 4-propoxyethoxyphenyl borate (346mg) and potassium carbonate (534mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (63mg), and the mixture was heated at 100°C for 4 hours under argon atmosphere. After allowing to cool, water was added to the mixture, which was made acidic (pH = 4) with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) and the resulting solid was recrystallized from hexane-ethyl acetate to give 1-(4-methoxybenzyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (117mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.2 Hz), 1.60 - 1.70 (m, 2H), 2.76 (br, 2H), 3.31 (br, 2H), 3.51 (t, 2H, J = 7.0 Hz), 3.79 - 3.84 (m, 5H), 4.16 (t, 2H, J = 4.6 Hz), 4.54 (s, 2H), 6.88 - 7.00 (m, 5H), 7.22 (d, 2H, J = 8.8 Hz), 7.39 (d, 1H, J = 10.6 Hz), 7.47 (d, 2H, J = 8.4 Hz), 7.56 (d, 1H, J = 2.2 Hz), 7.92 (s, 1H).

Reference Example 165

[0360] In toluene (20ml), ethanol (2ml) and water (2ml) were suspended 7-bromo-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (300mg), 4-butoxyethoxyphenyl borate (368mg) and potassium carbonate (534mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (63mg), and the mixture was heated at 100°C for 6 hours under argon atmosphere. After allowing to cool, water was added to the mixture, which was made acidic (pH = 4) with 1N hydrochloric acid and extracted with ethyl acetate twice. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 1) and the resulting solid was washed with hexane to give 7-(4-butoxyethoxyphenyl)-1-(4-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (149mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.25 - 1.41 (m, 2H), 1.58 - 1.65 (m, 2H), 2.76 (br, 2H), 3.31 (br, 2H), 3.56 (t, 2H, J = 7.0 Hz), 3.78 - 3.82 (m, 5H), 4.16 (t, 2H, J = 5.4 Hz), 4.54 (s, 2H), 6.88 - 7.000 (m, 5H), 7.22 (d, 2H, J = 8.4 Hz), 7.39 (dd, 1H, J = 10.2, 2.4 Hz), 7.47 (d, 2H, J = 8.8 Hz), 7.57 (d, 1H, J = 2.4 Hz), 7.92 (s, 1H). Anal. Calcd. C₃₁H₃₅NO₃ Calcd. C, 74.23; H, 7.03; N, 2.79. Found C, 73.88; H, 6.78; N, 2.85.

Reference Example 166

[0361] To a solution of methyl 7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 3-thiophenecarboxaldehyde (441mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (416mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-propoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (375mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.60 - 1.70 (m, 2H), 2.76 (t, 2H, J = 3.6 Hz), 3.31 (t, 2H, J = 3.6 Hz), 3.51 (t, 2H, J = 6.6 Hz), 3.79 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.2 Hz), 4.56 (s, 2H), 6.90 - 7.04 (m, 4H), 7.12 - 7.14 (m, 1H), 7.32 - 7.45 (m, 2H), 7.47 (d, 2H, J = 8.6 Hz), 7.55 (d, 1H, J = 2.2 Hz), 7.81 (s, 1H).

Reference Example 167

[0362] To a solution of methyl 7-(4-propoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (375mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature overnight. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-(4-propoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (317mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.56 - 1.74 (m, 2H), 2.78 (t, 2H, J = 4.4 Hz), 3.51 (t, 2H, J = 6.8 Hz), 3.81 (t, 2H, J = 4.4 Hz), 4.17 (t, 2H, J = 5.2 Hz), 4.58 (s, 2H), 6.91 - 7.05 (m, 4H), 7.13 (br, 1H), 7.33 - 7.49 (m, 4H), 7.56 (d, 1H, J = 2.2 Hz), 7.91 (s, 1H).

Anal. Calcd. C₂₇H₂₉NO₄S Calcd. C, 69.95; H, 6.31; N, 3.02. Found C, 69.78; H, 6.30; N, 3.01.

Reference Example 168

[0363] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 3-thiophenecarboxyaldehyde (426mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (402mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (373mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz); 1.25 - 1.45 (m, 2H), 1.57 - 1.65 (m, 2H), 2.76 (t, 2H, J = 3.6 Hz), 3.31 (t, 2H, J = 4.6 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.2 Hz), 4.56 (s, 2H), 6.90 - 7.13 (m, 5H), 7.32 - 7.41 (m, 2H), 7.47 (d, 2H, J = 8.8 Hz), 7.55 (s, 1H), 7.81 (s, 1H).

Reference Example 169

[0364] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (373mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (297mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.57 - 1.65 (m, 2H), 2.78 (t, 2H, J = 4.0 Hz), 3.29 (t, 2H, J = 4.0 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.8 Hz), 4.16 (t, 2H, J = 5.2 Hz), 4.57 (s, 2H), 6.73 - 7.00 (m, 3H), 7.03 (dd, 1H, J = 5.0, 1.4 Hz), 7.33 - 7.49 (m, 4H), 7.56 (d, 1H, J = 1.8 Hz), 7.90 (s, 1H).

Anai. Calcd. C₂₈H₃₁NO₄S·0.1H₂O Calcd. C, 70.14; H, 6.56; N, 2.92. Found C, 69.85; H, 6.46; N, 2.86.

Reference Example 170

[0365] One droplet of pyridine was added to a solution of 2-hydroxymethylthiophene (1.0g) in toluene (10ml), followed by addition of thionyl chloride (1.56g). The mixture was stirred at room temperature for 1 hour, ethyl acetate was added thereto, and the mixture was washed with water. The organic layer was washed with 1N sodium hydroxide solution, water and saturated brine, and dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give 2-chloromethylthiophene (1.16g) as deep brown oil.

¹H-NMR (200 MHz, CDCl₃) δ 4.82 (s, 2H), 6.93 - 7.00 (m, 1H), 7.09 (d, 1H, J = 3.0 Hz), 7.31 (dd, 1H, J = 5.2, 1.0 Hz).

Reference Example 171

[0366] To a suspension of 60% sodium hydride (0.16g) in DMF (5ml) which had been washed with hexane three times was added dropwise a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (1.00g) in DMF (10ml) under nitrogen atmosphere at 0°C. The temperature was returned to room temperature and the mixture was stirred for 1 hour. Then, to the mixture was added dropwise a solution of 2-chloromethylthiophene (1.07g) in DMF (5ml) at 0°C. To the mixture was added sodium iodide (0.83g), and the mixture was heated at 60°C overnight. To the mixture were added ethyl acetate and water, and the mixture was separated. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 5 : 1) to give methyl 7-bromo-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.82g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.78 (t, 2H, J = 3.6 Hz), 3.27 (t, 2H, J = 3.6 Hz), 3.80 (s, 3H), 4.65 (s, 2H), 6.82 (d, 1H, J = 7.8 Hz), 6.70 - 7.03 (m, 2H), 7.24 - 7.35 (m, 2H), 7.47 (d, 1H, J = 2.8 Hz), 7.61 (s, 1H).

Reference Example 172

[0367] To a solution of methyl 7-bromo-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (810mg) in a mixture of tetrahydrofuran (60ml) and methanol (60ml) was added 1N sodium hydroxide solution (21ml), and the mixture was stirred at room temperature overnight. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-bromo-1-(2-thienylmethyl)-

2,3-dihydro-1-benzazepine-4-carboxylic acid (574mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 2.79 (t, 2H, J = 4.4 Hz), 3.30 (t, 2H, J = 4.8 Hz), 4.66 (s, 2H), 6.83 (d, 1H, J = 4.4 Hz), 6.97 - 7.01 (m, 2H), 7.24 - 7.49 (m, 21H), 7.48 (d, 1H, J = 2.4 Hz), 7.71 (s, 1H).

Anal. Calcd. C₁₆H₁₄NO₂SBr Calcd. C, 52.76; H, 3.87; N, 3.85. Found C, 52.80; H, 3.95; N, 3.68.

Reference Example 173

[0368] In toluene (30ml), ethanol (3ml) and water (3ml) were suspended 7-bromo-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (500mg), 4-propoxyethoxyphenyl borate (615mg) and potassium carbonate (949mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (111mg), and the mixture was heated under argon atmosphere at 100°C for 6 hours. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1), which was recrystallized from hexane-ethyl acetate to give 7-(4-propoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (269mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.6 Hz), 1.59 - 1.74 (m, 2H), 2.79 (br, 2H), 3.30 (br, 2H), 3.51 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 5.0 Hz), 4.15 (br, 2H), 4.68 (br, 2H), 6.90 - 7.10 (m, 5H), 7.23 - 7.26 (m, 1H), 7.43 - 7.47 (m, 3H), 7.54 (br, 1H), 7.90 (s, 1H).

Anal. Calcd. C₂₇H₂₉NO₄S·0.2H₂O Calcd. C, 69.41; H, 6.34; N, 3.00. Found C, 69.18; H, 6.05; N, 3.01.

Reference Example 174

[0369] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and thiophene-2-carboxaldehyde (422mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (796mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate.

[0370] The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (373mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.30 - 1.47 (m, 2H), 1.56 - 1.71 (m, 2H), 2.80 (t, 2H, J = 5.4 Hz), 3.32 (t, 2H, J = 5.4 Hz), 3.55 (t, 2H, J = 7.0 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.71 (s, 2H), 6.96 - 7.02 (m, 5H), 7.29 (dd, 1H, J = 4.8, 1.4 Hz), 7.40 - 7.49 (m, 3H), 7.55 (d, 1H, J = 2.2 Hz), 7.80 (s, 1H).

Reference Example 175

[0371] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (373mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-thienylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (249mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.70 (m, 4H), 2.81 (t, 2H, J = 3.6 Hz), 3.34 (t, 2H, J = 3.6 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.2 Hz), 4.16 (t, 2H, J = 5.6 Hz), 4.72 (s, 2H), 6.96 - 7.04 (m, 5H), 7.26 - 7.31 (m, 1H), 7.41 - 7.49 (m, 3H), 7.55 (d, 1H, J = 2.2 Hz), 7.89 (s, 1H).

Anal. Calcd. C₂₈H₃₁NO₄S Calcd. C, 70.41; H, 6.54; N, 2.93. Found C, 70.15; H, 6.51; N, 2.79.

Reference Example 176

[0372] To a solution of methyl 7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 3-furaldehyde (378mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (416mg), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 1-(3-furylmethyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (362mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.57 - 1.70 (m, 2H), 2.76 (t, 2H, J = 5.2 Hz), 3.27 (t, 2H, J = 5.2 Hz), 3.51 (t, 2H, J = 7.0 Hz), 3.79 - 3.84 (m, 5H), 4.16 (t, 2H, J = 5.2 Hz), 4.38 (s, 2H), 6.37 (d, 1H, J = 0.8 Hz), 6.96 - 7.00 (m, 3H), 7.38 - 7.49 (m, 5H), 7.54 (d, 1H, J = 2.2 Hz), 7.79 (s, 1H).

5 Reference Example 177

[0373] To a solution of methyl 1-(3-furylmethyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (362mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 5 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was washed with hexane to give 1-(3-furylmethyl)-7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (307mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (t, 3H, J = 7.4 Hz), 1.60 - 1.70 (m, 2H), 2.80 (br, 2H), 3.30 (b, 2H), 3.52 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.0 Hz), 4.17 (t, 2H, J = 5.0 Hz), 4.40 (s, 2H), 6.39 (s, 1H), 6.95 - 7.01 (m, 3H), 7.39 - 7.49 (m, 5H), 7.54 (d, 1H, J = 2.2 Hz), 7.89 (s, 1H).

Anal. Calcd. C₂₇H₂₉NO₅ Calcd. C, 72.46; H, 6.53; N, 3.13. Found C, 72.13; H, 6.45; N, 3.00.

20 Reference Example 178

[0374] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 3-furaldehyde (365mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (402mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 5 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(3-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (310mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.50 (m, 2H), 1.56 - 1.69 (m, 2H), 2.76 (t, 2H, J = 7.2 Hz), 3.28 (t, 2H, J = 5.6 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78-3.83 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.38 (s, 2H), 6.38 (d, 1H, J = 0.8 Hz), 6.93 - 7.00 (m, 3H), 7.39 - 7.49 (m, 5H), 7.54 (d, 1H, J = 2.2 Hz), 7.79 (s, 1H).

Reference Example 179

[0375] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (310mg) in a mixture of tetrahydrofuran (21ml) and methanol (21ml) was added 1N sodium hydroxide solution (7ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting solid was washed with hexane to give 7-(4-butoxyethoxyphenyl)-1-(3-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (312mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.31 - 1.45 (m, 2H), 1.55 - 1.70 (m, 2H), 2.79 (t, 2H, J = 4.6 Hz), 3.30 (t, 2H, J = 4.6 Hz), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.8 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.40 (s, 2H), 6.38 (s, 1H), 6.95 - 7.01 (m, 3H), 7.40 - 7.49 (m, 5H), 7.55 (d, 1H, J = 2.2 Hz), 7.90 (s, 1H).

Anal. Calcd. C₂₈H₃₁NO₅·0.2H₂O Calcd. C, 72.29; H, 6.80; N, 3.01. Found C, 72.15; H, 6.95; N, 2.93.

45 Reference Example 180

[0376] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2-ethoxybenzaldehyde (570mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (402mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 5 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-ethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (402mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.33 - 1.64 (m, 7H), 2.81 (t, 2H, J = 4.4 Hz), 3.34 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.82 (m, 5H), 4.04 - 4.18 (m, 4H), 4.58 (s, 2H), 6.74 - 6.99 (m, 6H), 7.14 (d, 1H, J = 7.8 Hz), 7.32 (dd, 1H, J = 8.4, 2.6 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.54 (d, 1H, J = 2.2 Hz), 7.84 (s, 1H).

Reference Example 181

[0377] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-ethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (402mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-ethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (297mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.47 (m, 5H), 1.50 - 1.65 (m, 2H), 2.83 (br, 2H), 3.37 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.4 Hz), 4.10 (q, 2H, J = 5.0 Hz), 4.16 (t, 2H, J = 4.8 Hz), 4.59 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.90 - 6.99 (m, 5H), 7.15 (d, 1H, J = 7.4 Hz), 7.26 - 7.37 (m, 1H), 7.46 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 2.2 Hz), 7.94 (s, 1H).

Anal. Calcd. C₃₂H₃₇NO₅ Calcd. C, 74.54; H, 7.23; N, 2.72. Found C, 74.48; H, 7.17; N, 2.92.

Reference Example 182

[0378] To a solution of 3-hydroxybenzaldehyde (10.0g) in DMF (120ml) were added potassium carbonate (15.8g) and 1-bromopropane (12.1g), and the mixture was stirred under nitrogen atmosphere at room temperature overnight. Then, water was added to the mixture, which was extracted with ethyl acetate and washed with magnesium sulfate, the solvent solution twice, with water three times and with saturated brine once. After dried with magnesium sulfate, the solvent was evaporated under reduced pressure to give 3-propoxybenzaldehyde (13.4g) as colorless liquid.

¹H-NMR (200 MHz, CDCl₃) δ 1.05 (t, 3H, J = 7.4 Hz), 1.75 - 1.93 (m, 2H), 3.99 (t, 2H, J = 6.6 Hz), 7.15 - 7.21 (m, 1H), 7.39 (d, 1H, J = 2.6 Hz), 7.41 - 7.45 (m, 2H).

Reference Example 183

[0379] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 3-propoxybenzaldehyde (623mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (804mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 5 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (412mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.89 - 1.09 (m, 6H), 1.33 - 1.45 (m, 2H), 1.55 - 1.65 (m, 2H), 1.74 - 1.85 (m, 2H), 2.78 (t, 2H, J = 5.2 Hz), 3.31 (t, 2H, J = 5.2 Hz), 3.55 (t, 2H, J = 7.0 Hz), 3.78 - 3.83 (m, 5H), 3.90 (t, 2H, J = 6.6 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.55 (s, 2H), 6.80 - 6.89 (m, 4H), 6.97 (d, 2H, J = 8.8 Hz), 7.22 - 7.49 (m, 4H), 7.54 (d, 1H, J = 2.2 Hz), 7.82 (s, 1H).

Reference Example 184

[0380] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (412mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (308mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.03 (t, 3H, J = 7.2 Hz), 1.30 - 1.50 (m, 2H), 1.50 - 1.70 (m, 2H), 1.74 - 1.85 (m, 2H), 2.81 (br, 2H), 3.35 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.6 Hz), 4.57 (s, 2H), 6.81 - 6.91 (m, 4H), 6.98 (d, 2H, J = 8.8 Hz), 7.24 - 7.35 (m, 1H), 7.38 (dd, 1H, J = 8.4, 1.4 Hz), 7.47 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 1.4 Hz), 7.93 (s, 1H).

Anal. Calcd. C₃₃H₃₉NO₅ Calcd. C, 74.83; H, 7.42; N, 2.64. Found C, 74.76; H, 7.38; N, 2.74.

Reference Example 185

[0381] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2,5-dimethoxybenzaldehyde (631mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride

(8042mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 5 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2,5-dimethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (290mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.37 - 1.45 (m, 2H), 1.55 - 1.70 (m, 2H), 3.82 (br, 2H), 3.34 (br, 2H), 3.55 (t, 2H, J = 7.0 Hz), 3.70 (s, 3H), 3.78 - 3.84 (m, 8H), 4.16 (t, 2H, J = 5.4 Hz), 4.53 (s, 2H), 6.75 - 6.83 (m, 4H), 6.97 (d, 2H, J = 8.8 Hz), 7.30 (dd, 1H, J = 8.8, 1.3 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.57 (d, 1H, J = 1.3 Hz), 7.83 (s, 1H).

Reference Example 186

[0382] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-propoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (290mg) in a mixture of tetrahydrofuran (21ml) and methanol (21ml) was added 1N sodium hydroxide solution (7ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2,5-dimethoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (237mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 6.8 Hz), 1.32 - 1.45 (m, 2H), 1.50 - 1.64 (m, 2H), 2.83 (br, 2H), 3.35 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.71 (s, 3H), 3.80 (t, 2H, J = 5.0 Hz), 3.84 (s, 3H), 4.16 (t, 2H, J = 5.6 Hz), 4.55 (s, 2H), 6.75 - 6.83 (m, 4H), 6.97 (d, 2H, J = 8.8 Hz), 7.35 (dd, 1H, J = 8.8, 1.3 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.54 (d, 1H, J = 1.3 Hz), 7.93 (s, 1H).

Anal. Calcd. C₃₂H₃₇NO₆·0.1H₂O Calcd. C, 72.05; H, 7.03; N, 2.63. Found C, 71.83; H, 7.18; N, 2.57.

Example Reference 187

[0383] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2-fluorobenzaldehyde (471mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (402mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 5 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane:ethyl acetate=3:1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-fluorobenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (382mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.30 - 1.45 (m, 2H), 1.54 - 1.70 (m, 2H), 2.80 (t, 2H, J = 4.0 Hz), 3.31 (t, 2H, J = 5.2 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.2 Hz), 4.63 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.95 - 7.48 (m, 9H), 7.56 (d, 1H, J = 2.2 Hz), 7.82 (s, 1H).

Reference Example 188

[0384] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-fluorobenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (382mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to make acidic (pH = 4), and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-fluorobenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (309mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.54 - 1.65 (m, 2H), 2.81 (br, 2H), 3.37 (br, 2H), 3.55 (t, 2H, J = 6.8 Hz), 3.80 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.6 Hz), 4.65 (s, 2H), 6.84 (d, 1H, J = 8.4 Hz), 6.98 (d, 2H, J = 8.8 Hz), 7.06 - 7.15 (m, 2H), 7.24 - 7.40 (m, 3H), 7.46 (d, 2H, J = 8.8 Hz), 7.57 (d, 1H, J = 2.6 Hz), 7.93 (s, 1H).

Anal. Calcd. C₃₀H₃₂NO₄F Calcd. C, 73.60; H, 6.59; N, 2.86. Found C, 73.48; H, 6.46; N, 3.01.

Reference Example 189

[0385] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (500mg) and 1-methyl-2-imidazolecarboxyaldehyde (696mg) in 1,2-dichloroethane (20ml) was added sodium triacetoxymethylborohydride (804mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue

was purified with silica gel column chromatography (ethyl acetate) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylimidazol-2-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (367mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.38 - 1.45 (m, 2H), 1.54 - 1.65 (m, 2H), 2.41 (t, 2H, J = 4.4 Hz), 3.30 (t, 2H, J = 5.0 Hz), 3.51 (s, 3H), 3.56 (t, 2H, J = 6.2 Hz), 3.79 - 3.83 (m, 5H), 4.17 (t, 2H, J = 4.4 Hz), 4.61 (s, 2H), 6.88 (d, 1H, J = 1.0 Hz), 6.97 - 7.06 (m, 4H), 7.44 - 7.50 (m, 3H), 7.56 (d, 2H, J = 2.2 Hz), 7.77 (s, 1H).

Reference Example 190

[0386] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylimidazol-2-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (367mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutralize, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylimidazol-2-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (285mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.30 - 1.50 (m, 2H), 1.54 - 1.70 (m, 2H), 2.47 (br, 2H), 3.32 (br, 2H), 3.54 - 3.59 (m, 5H), 3.80 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.68 (s, 2H), 6.88 (s, 1H), 6.98 (d, 2H, J = 8.4 Hz), 7.03 - 7.07 (m, 2H), 7.45 - 7.49 (m, 3H), 7.57 (d, 1H, J = 2.2 Hz), 7.85 (s, 1H).
Anal. Calcd. C₂₈H₃₅N₃O₄ Calcd. C, 70.42; H, 7.39; N, 8.80. Found C, 70.27; H, 7.43; N, 8.73.

Reference Example 191

[0387] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 2-thiazolecarboxyaldehyde (445mg) in 1,2-dichloroethane (20ml) was added sodium triacetoxyborohydride (416mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(thiazol-2-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (212mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.57 - 1.70 (m, 2H), 2.87 (t, 2H, J = 4.4 Hz), 3.42 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.82 (m, 5H), 4.16 (t, 2H, J = 5.6 Hz), 4.86 (s, 2H), 6.95 - 7.00 (m, 3H), 7.30 (d, 1H, J = 3.2 Hz), 7.40 (dd, 1H, J = 8.4, 2.2 Hz), 7.46 (d, 2H, J = 8.6 Hz), 7.56 (d, 1H, J = 2.6 Hz), 7.78 - 7.81 (m, 2H).

Reference Example 192

[0388] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(thiazol-2-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (212mg) in a mixture of tetrahydrofuran (18ml) and methanol (18ml) was added 1N sodium hydroxide solution (6ml), and the mixture was stirred at room temperature overnight. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(thiazol-2-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (153mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.6 Hz), 1.34 - 1.45 (m, 2H), 1.54 - 1.65 (m, 2H), 2.89 (br, 2H), 3.45 (br, 2H), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.6 Hz), 4.88 (s, 2H), 6.96 - 7.01 (m, 3H), 7.31 (d, 1H, J = 3.2 Hz), 7.46 - 7.49 (m, 3H), 7.57 (d, 1H, J = 2.6 Hz), 7.80 (d, 1H, J = 3.4 Hz), 7.91 (s, 1H).
Anal. Calcd. C₂₇H₃₀N₂O₄S Calcd. C, 67.76; H, 6.32; N, 5.85. Found C, 67.76; H, 6.39; N, 5.70.

Reference Example 193

[0389] To a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (1.5g) and 2-methoxybenzaldehyde (3.62g) in 1,2-dichloroethane (50ml) was added sodium triacetoxyborohydride (2.82g), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane:ethyl acetate=5:1) to give methyl 7-bromo-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.62g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.79 (t, 2H, J = 5.2 Hz), 3.29 (t, 2H, J = 5.6 Hz), 3.80 (s, 3H), 3.86 (s, 3H), 4.50 (s, 2H),

6.60 (d, 1H, J = 9.2 Hz), 6.88 - 7.07 (m, 3H), 7.16 (dd, 1H, J = 8.8, 2.6 Hz), 7.20 - 7.31 (m, 1H), 7.46 (d, 1H, J = 2.6 Hz), 7.64 (s, 1H).

Reference Example 194

5

[0390] In toluene (25ml), ethanol (2.5ml) and water (2.5ml) were suspended methyl 7-bromo-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (712mg), 4-propoxyphenyl borate (416mg) and potassium carbonate (636mg), and the suspension was stirred under argon atmosphere for 30 minutes. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (143mg) and the mixture was heated under argon atmosphere at 100°C for 5 hours. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-propoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (663mg) as yellow oil.

15 ¹H-NMR (200 MHz, CDCl₃) δ 1.05 (t, 3H, J = 7.2 Hz); 1.81 - 1.88 (m, 2H), 2.82 (t, 2H, J = 5.2 Hz), 3.34 (t, 2H, J = 5.2 Hz), 3.82 (s, 3H), 3.88 (s, 3H), 3.95 (t, 2H, J = 6.6 Hz), 4.56 (s, 2H), 6.76 - 7.15 (m, 6H), 7.26 - 7.35 (m, 2H), 7.45 (d, 2H, J = 8.8 Hz), 7.57 - 7.60 (m, 1H), 7.84 (s, 1H).

Reference Example 195

20

[0391] To a solution of methyl 7-(propoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylate (601mg) in a mixture of tetrahydrofuran (39ml) and methanol (39ml) was added 1N sodium hydroxide solution (13ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-propoxyphenyl)-1-(2-methoxybenzyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (406mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 1.05 (t, 3H, J = 7.2 Hz), 1.77 - 1.88 (m, 2H), 2.84 (t, 2H, J = 4.8 Hz), 3.37 (t, 2H, J = 4.8 Hz), 3.88 (s, 3H), 3.95 (t, 2H, J = 6.6 Hz), 4.58 (s, 2H), 6.79 (d, 1H, J = 8.8 Hz), 6.92 - 6.96 (m, 4H), 7.14 (d, 1H, J = 6.0 Hz), 7.26 - 7.37 (m, 2H), 7.46 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 2.2 Hz), 7.95 (s, 1H).

Anal. Calcd. C₂₉H₂₉NO₄·0.3H₂O Calcd. C, 75.56; H, 6.47; N, 3.04. Found C, 75.47; H, 6.58; N, 3.04.

Reference Example 196

35 [0392] To a suspension of 60% sodium hydride (1.5g) in dry tetrahydrofuran (30ml) which had been washed with hexane three times was added dropwise a solution of 4-bromopyrazole (5.0g) in dry tetrahydrofuran (30ml) under nitrogen atmosphere at 0°C, the temperature was returned to room temperature, and the mixture was stirred for 1 hour. To the mixture was added dropwise a solution of methyl iodide (5.31g) in dry tetrahydrofuran (20ml) under nitrogen atmosphere at 0°C, the temperature was returned to room temperature, and the mixture was stirred for 3 hours. The solution was diluted with tetrahydrofuran, and the insolubles were filtered with Celite. After the filtrate was concentrated under reduced pressure, hexane was further added, and the insolubles were filtered. The filtrate was concentrated under reduced pressure to give 4-bromo-1-methylpyrazole (5.12g) as light yellow liquid.

¹H-NMR (200 MHz, CDCl₃) δ 3.89 (s, 3H), 7.38 (s, 1H), 7.44 (s, 1H).

45 Reference Example 197

[0393] To a solution of 4-bromo-1-methylpyrazole (3.0g) in dry tetrahydrofuran (50ml) was added dropwise n-butyllithium (14.0ml, 1.6M solution in hexane) under nitrogen atmosphere at -78°C. After 30 minutes, DMF (6.8g) was added dropwise under nitrogen atmosphere at -78°C, the temperature was returned to room temperature, and the mixture was stirred for 1 hour. Then, 1N hydrochloric acid (50ml) was added thereto at 0°C, and the mixture was stirred for 30 minutes, made basic with 1N sodium hydroxide solution and extracted with ethyl acetate three times. The extract was dried with magnesium sulfate, the solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 2) to give 1-methylpyrazole-4-carboxaldehyde (540mg) as light yellow oil.

55 ¹H-NMR (200 MHz, CDCl₃) δ 3.97 (s, 3H), 7.91 (s, 1H), 7.96 (s, 1H), 9.86 (s, 1H).

Reference Example 198

5 **[0394]** To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (388mg) and 1-methylpyrazole-4-carboxyaldehyde (540mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxymethylborohydride (519mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 3) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (321mg) as yellow oil.

10 ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.70 (m, 2H), 2.76 (t, 2H, J = 5.0 Hz), 3.27 (t, 2H, J = 5.0 Hz), 3.56 (t, 2H, J = 7.0 Hz), 3.78-3.83 (m, 5H), 3.89 (s, 3H), 4.16 (t, 2H, J = 5.2 Hz), 4.42 (s, 2H), 6.92 - 7.00 (m, 3H), 7.29 (s, 1H), 7.40 (dd, 1H, J = 8.4, 1.8 Hz), 7.45 - 7.49 (m, 3H), 7.54 (d, 1H, J = 2.2 Hz), 7.78 (s, 1H).

Reference Example 199

15 **[0395]** To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (321mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate.

20 The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (239mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34-1.49 (m, 2H), 1.55 - 1.65 (m, 2H), 2.79 (t, 2H, J = 4.2 Hz), 3.30 (t, 2H, J = 4.2 Hz), 3.56 (t, 2H, J = 8.6 Hz), 3.81 (t, 2H, J = 4.8 Hz), 3.90 (s, 3H), 4.16 (t, 2H, J = 5.2 Hz), 4.44 (s, 2H), 6.94 - 7.01 (m, 3H), 7.30 (s, 1H), 7.40-7.50 (m, 4H), 7.56 (d, 1H, J = 2.0 Hz), 7.90 (s, 1H).

25 Anal. Calcd. C₂₉H₃₃N₃O₄ Calcd. C, 70.71; H, 6.99; N, 8.84. Found C, 70.52; H, 6.90; N, 8.70.

Reference Example 200

30 **[0396]** To a solution of 1-methylpyrazole (10.0g) in dry tetrahydrofuran (200ml) was added dropwise n-butyllithium (91.3ml, 1.6M solution in hexane) at -78°C under nitrogen atmosphere. After 30 minutes, DMF (44.6g) was added dropwise thereto at -78°C under nitrogen atmosphere, the temperature was returned to room temperature, and the mixture was stirred for 2 hours. Then, to the mixture was added 1N hydrochloric acid (200ml) at 0°C, the mixture was stirred for 30 minutes, made basic with 1N sodium hydroxide solution, and extracted with ethyl acetate three times.

35 The mixture was dried with magnesium sulfate, and the solvent was evaporated under reduced pressure to give 1-methyl-5-pyrazolecarboxyaldehyde (11.7g) as light yellow oil. ¹H-NMR (200 MHz, CDCl₃) δ 4.19 (s, 3H), 6.90 (d, 1H, J = 2.2 Hz), 7.54 (d, 1H, J = 1.8 Hz), 9.88 (s, 1H).

Reference Example 201

40 **[0397]** To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (500mg) and 1-methylpyrazole-5-carboxyaldehyde (696mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxymethylborohydride (670mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 3) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (391mg) as yellow oil.

45 ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.55 - 1.70 (m, 2H), 2.58 (t, 2H, J = 4.8 Hz), 3.27 (t, 2H, J = 4.8 Hz), 3.56 (t, 2H, J = 7.0 Hz), 3.79-3.83 (m, 8H), 4.17 (t, 2H, J = 4.4 Hz), 4.52 (s, 2H), 6.22 (d, 1H, J = 1.8 Hz), 6.92 (d, 1H, J = 8.8 Hz), 6.99 (d, 2H, J = 8.8 Hz), 7.40 - 7.50 (m, 4H), 7.57 (d, 1H, J = 2.2 Hz), 7.79 (s, 1H).

50

Reference Example 202

55 **[0398]** To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (391mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was

evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (263mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.45 (m, 2H), 1.55 - 1.65 (m, 2H), 2.62 (br, 2H), 3.30 (br, 2H), 3.56 (t, 2H, J = 7.0 Hz), 3.79 - 3.84 (m, 5H), 4.17 (t, 2H, J = 5.0 Hz), 4.54 (s, 2H), 6.22 (d, 1H, J = 1.8 Hz), 6.93 (d, 1H, J = 8.8 Hz), 6.99 (d, 2H, J = 8.8 Hz), 7.43 - 7.50 (m, 4H), 7.58 (d, 1H, J = 2.2 Hz), 7.89 (s, 1H).
Anal. Calcd. C₂₈H₃₃N₃O₄ Calcd. C, 70.71; H, 6.99; N, 8.84. Found C, 70.48; H, 6.90; N, 8.80.

Reference Example 203

[0399] 2,5-dimethylisooxazole (10.0g) was dissolved in water (100ml). To the solution were added concentrated sulfuric acid (35.3g) and 40% aqueous formaldehyde solution (46.4g) at 0°C, and the mixture was heated at 70°C overnight. The mixture was neutralized with 1N sodium hydroxide solution at 0°C and extracted with chloroform three times. The extract was dried with magnesium sulfate, the solvent was evaporated under reduced pressure, and the resulting residue was distilled under reduced pressure to give 4-hydroxymethyl-2,5-dimethylisooxazole (2.54g) as colorless liquid.

¹H-NMR (200 MHz, CDCl₃) δ 2.31 (s, 3H), 2.39 (s, 3H), 4.48 (s, 2H).

Reference Example 204

[0400] To a solution of 4-hydroxymethyl-2,5-dimethylisooxazole (2.45g) in ethyl acetate (500ml) was added active manganese dioxide (24.5g), and the mixture was stirred at room temperature for 3 days. The insolubles were filtered using Celite, and the filtrate was concentrated under reduced pressure to give 2,3-dimethylisooxazole-4-carboxyaldehyde (1.5g) as colorless oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.42 (s, 3H), 2.69 (s, 3H), 9.95 (s, 1H).

Reference Example 205

[0401] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (500mg) and 2,5-dimethylisooxazole-4-carboxyaldehyde (791mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxymethylborohydride (2.0g), and the mixture was stirred under nitrogen atmosphere at room temperature for 7 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(2,5-dimethylisooxazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (309mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.34 - 1.48 (m, 2H), 1.49 - 1.68 (m, 2H), 2.19 (s, 3H), 2.27 (s, 3H), 2.59 (t, 2H, J = 4.0 Hz), 3.13 (t, 2H, J = 4.4 Hz), 3.56 (t, 2H, J = 6.6 Hz), 3.79 - 3.84 (m, 5H), 4.17 (t, 2H, J = 4.6 Hz), 4.26 (s, 2H), 6.93 (d, 1H, J = 8.4 Hz), 6.99 (d, 2H, J = 8.8 Hz), 7.42 - 7.50 (m, 3H), 7.57 (d, 1H, J = 2.2 Hz), 7.78 (s, 1H).

Reference Example 206

[0402] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-methylpyrazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (222mg) in a mixture of tetrahydrofuran (13ml) and methanol (13ml) was added 1N sodium hydroxide solution (4.4ml), and the mixture was stirred at room temperature for 4 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(2,5-dimethylisooxazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (164mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.0 Hz), 1.34-1.45 (m, 2H), 1.55-1.65 (m, 2H), 2.20 (s, 3H), 2.39 (s, 3H), 2.62 (br, 2H), 3.16 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.4 Hz), 4.17 (t, 2H, J = 5.0 Hz), 4.28 (s, 2H), 6.93 - 7.02 (m, 3H), 7.46 - 7.51 (m, 3H), 7.58 (d, 1H, J = 2.2 Hz), 7.87 (s, 1H).

Anal. Calcd. C₂₉H₃₅N₂O₅ Calcd. C, 70.85; H, 7.18; N, 5.70. Found C, 70.71; H, 6.90; N, 5.43.

Reference Example 207

[0403] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (400mg) and furfural (485mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxymethylborohydride (536mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the

mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (319mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.30 - 1.45 (m, 2H), 1.46 - 1.70 (m, 2H), 2.77 (t, 2H, J = 4.0 Hz), 3.30 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.49 (s, 2H), 6.28 (d, 2H, J = 3.4 Hz), 6.37 (dd, 1H, J = 2.8, 1.8 Hz), 6.98 (d, 2H, J = 8.8 Hz), 7.06 (d, 1H, J = 8.8 Hz), 7.41 - 7.50 (m, 4H), 7.54 (d, 1H, J = 2.2 Hz), 7.79 (s, 1H).

Reference Example 208

[0404] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-furylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (319mg) in a mixture of tetrahydrofuran (21ml) and methanol (21ml) was added 1N sodium hydroxide solution (7ml), and the mixture was stirred at room temperature for 5 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-furylme-
thyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (256mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.50 (m, 2H), 1.55 - 1.70 (m, 2H), 2.79 (t, 2H, J = 4.4 Hz), 3.33 (t, 2H, J = 4.4 Hz), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.8 Hz), 4.17 (t, 2H, J = 4.8 Hz), 4.50 (s, 2H), 6.29 (d, 1H, J = 3.2 Hz), 6.38 (dd, 1H, J = 2.8, 1.8 Hz), 6.99 (d, 2H, J = 8.8 Hz), 7.08 (d, 1H, J = 9.0 Hz), 7.42 - 7.50 (m, 4H), 7.55 (d, 1H, J = 2.2 Hz), 7.90 (s, 1H).
Anal. Calcd. C₂₈H₃₁NO₅ Calcd. C, 72.86; H, 6.77; N, 3.03. Found C, 72.63; H, 6.67; N, 2.82.

Reference Example 209

[0405] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (400mg) and pyridine-2-carboxyaldehyde (542mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxyborohydride (1.07g), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-pyridylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (378mg) as yellow oil. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.65 (m, 2H), 2.84 (t, 2H, J = 4.4 Hz), 3.40 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.8 Hz), 3.78 - 3.82 (m, 5H), 4.15 (t, 2H, J = 5.2 Hz), 4.71 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.97 (d, 2H, J = 8.8 Hz), 7.21 - 7.29 (m, 2H), 7.35 (dd, 1H, J = 8.8, 2.2 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 2.2 Hz), 7.67 (td, 1H, J = 9.0, 2.0 Hz), 7.83 (s, 1H), 8.62 (d, 1H, J = 4.0 Hz).

Reference Example 210

[0406] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-pyridylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (378mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 2 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-pyridylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (260mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.30 - 1.48 (m, 2H), 1.54 - 1.68 (m, 2H), 2.87 (t, 2H, J = 4.4 Hz), 3.43 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 5.6 Hz), 4.74 (s, 2H), 6.83 (d, 1H, J = 8.8 Hz), 6.97 (d, 2H, J = 8.8 Hz), 7.20 - 7.31 (m, 2H), 7.37 (dd, 1H, J = 8.8, 2.2 Hz), 7.46 (d, 2H, J = 8.4 Hz), 7.58 (d, 1H, J = 1.8 Hz), 7.69 (td, 1H, J = 7.8, 2.0 Hz), 7.94 (s, 1H), 8.64 (d, 1H, J = 5.2 Hz).
Anal. Calcd. C₂₉H₃₂N₂O₄·0.3H₂O Calcd. C, 72.87; H, 6.87; N, 5.86. Found C, 72.74; H, 6.73; N, 5.69.

Reference Example 211

[0407] To a solution of acetamide (4.0g) in tetrahydrofuran (300ml) was added sodium hydrogen carbonate (28.4g), followed by addition of 80% ethyl bromopyruvate (21.5g) at 0°C. The mixture was heated at 85°C overnight, the temperature was returned to room temperature, the insolubles were filtered using Celite and the solvent was evaporated under reduced pressure. The resulting residue was dissolved in tetrahydrofuran (150ml), and to the solution was added

dropwise trifluoroacetic anhydride at 0°C. After concentrated under reduced pressure, to the mixture was added ethyl acetate, and the mixture was washed with saturated sodium hydrogen carbonate solution twice and further with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, followed by distillation under reduced pressure to give ethyl 2-methyloxazole-4-carboxylate (4.67g).

5 ¹H-NMR (200 MHz, CDCl₃) δ 1.38 (t, 3H, J = 7.4 Hz), 2.54 (s, 3H), 4.39 (q, 2H, J = 7.4 Hz), 8.14 (s, 1H).

Reference Example 212

10 [0408] A suspension of aluminum lithium hydride (553mg) in tetrahydrofuran (20ml) was added dropwise a solution of ethyl 2-methyl-oxazole-4-carboxylate (2.26g) in tetrahydrofuran (20ml) under nitrogen atmosphere, and the mixture was stirred at room temperature for 6 hours. To the mixture were successively added water (0.55ml), 15% sodium hydroxide solution (0.55ml) and water (1.65ml), the mixture was stirred at room temperature for 2 hours and dried with magnesium sulfate. The insolubles were filtered using Celite, and the solvent was evaporated under reduced pressure to give 4-hydroxymethyl-2-methyloxazole (1.11g).

15 ¹H-NMR (200 MHz, CDCl₃) δ 2.45 (s, 3H), 4.56 (d, 2H, J = 1.0 Hz), 7.48 (s, 1H).

Reference Example 213

20 [0409] To a solution of oxalyl chloride (3.53g) in dichloromethane (100ml) was added dropwise a solution of DMSO (2.89g) in dichloromethane (10ml) at -78°C. Then, to the mixture was added dropwise a solution of 4-hydroxymethyl-2-methyloxazole in dichloromethane (50ml), and the mixture was stirred at -45°C for 1 hour. Then, to the mixture was added dropwise triethylamine (10.3g) at -45°C, and the mixture was stirred at 0°C for 30 minutes. To the mixture were added saturated aqueous ammonium chloride solution (50ml) and water (200ml), and the mixture was extracted with ethyl acetate and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane:ethyl acetate=1:1) to give 2-methyloxazole-4-carboxaldehyde (0.10g) as brown crystals.

25 ¹H-NMR (200 MHz, CDCl₃) δ 2.55 (s, 3H), 8.17 (s, 1H), 9.91 (s, 1H).

Reference Example 214

30 [0410] To a solution of thioacetamide (11.9g) in tetrahydrofuran (600ml) was added sodium hydrogen carbonate (66.4g), followed by addition of 80% ethyl bromopyruvate (50.0g) at 0°C. The mixture was stirred overnight, the insolubles were filtered using Celite and the solvent was evaporated under reduced pressure. The resulting residue was dissolved in tetrahydrofuran (170ml), and to the solution was added dropwise trifluoroacetic anhydride (170ml) at 0°C, and the mixture was stirred at room temperature for 1 hour. To the mixture was added dropwise pyridine (200ml) at 0°C, and the mixture was stirred at room temperature for 3 hours. The solvent was evaporated under reduced pressure, to the mixture was added ethyl acetate, and the mixture was washed with saturated sodium hydrogen carbonate solution and further with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 2 : 1) to give ethyl 2-methylthiazole-4-carboxylate (13.0g) as brown crystals.

40 ¹H-NMR (200 MHz, CDCl₃) δ 1.41 (t, 3H, J = 7.4 Hz), 2.78 (s, 3H), 4.43 (q, 2H, J = 7.4 Hz), 8.04 (s, 1H).

Reference Example 215

45 [0411] A suspension of aluminum lithium hydride (0.89g) in tetrahydrofuran (20ml) was added dropwise a solution of ethyl 2-methylthiazole-4-carboxylate (4.00g) in tetrahydrofuran (30ml) under nitrogen atmosphere, and the mixture was stirred at room temperature for 2 hours. To the mixture were successively added water (0.9ml), 15% sodium hydroxide solution (0.9ml) and water (2.7ml), the mixture was stirred at room temperature for 2 hours and dried with magnesium sulfate. The insolubles were filtered using Celite, and the solvent was evaporated under reduced pressure to give 4-hydroxymethyl-2-methylthiazole (2.18g).

50 ¹H-NMR (200 MHz, CDCl₃) δ 2.71 (s, 3H), 4.73 (d, 2H, J = 0.8 Hz), 7.03 (s, 1H).

Reference Example 216

55 [0412] To a solution of 4-hydroxymethyl-2-methylthiazole (2.18g) in ethyl acetate (50ml) was added active manganese (21.8g), and the mixture was stirred at room temperature for 1 day. The insolubles were filtered using Celite, and the filtrate was concentrated under reduced pressure to give 2-methylthiazole-4-carboxaldehyde (0.9g) as brown oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.80 (s, 3H), 8.05 (s, 1H), 9.99 (s, 1H).

Reference Example 217

[0413] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (500mg) and 2-methylthiazole-4-carboxyaldehyde (804mg) in 1,2-dichloroethane (20ml) was added sodium triacetoxymethylborohydride (1.6g), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 2) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(2-methylthiazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (550mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.45 (m, 2H), 1.54 - 1.65 (m, 2H), 2.74 (s, 3H), 2.83 (t, 2H, J = 4.4 Hz), 3.38 (t, 2H, J = 4.0 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.65 (s, 2H), 6.89 - 6.99 (m, 4H), 7.37 (dd, 1H, J = 8.8, 2.2 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.54 (d, 1H, J = 2.2 Hz), 7.81 (s, 1H).

Reference Example 218

[0414] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(2-methylthiazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (550mg) in a mixture of tetrahydrofuran (33ml) and methanol (33ml) was added solution (11ml), and the mixture was stirred at room temperature for 2 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(2-methylthiazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (427mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.58 - 1.65 (m, 2H), 2.75 (s, 3H), 2.85 (t, 2H, J = 4.4 Hz), 3.40 (t, 2H, J = 4.4 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.80 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.4 Hz), 4.66 (s, 2H), 6.90 - 7.00 (m, 4H), 7.40 (dd, 1H, J = 9.4, 2.6 Hz), 7.46 (d, 2H, J = 8.8 Hz), 7.55 (d, 1H, J = 2.2 Hz), 7.91 (s, 1H). Anal. Calcd. C₂₈H₃₂N₂O₄ Calcd. C, 68.27; H, 6.55; N, 5.69. Found C, 68.25; H, 6.69; N, 5.82.

Reference Example 219

[0415] In water (28ml) and ice (100cc) was suspended 5-amino-3-methylisothiazole hydrochloride (10.0g), and concentrated sulfuric acid (28ml) was added to the suspension. Then, to the mixture was added dropwise a solution of sodium nitrite (4.82g) in water (100ml) at 0°C. The mixture was stirred at 0°C for 1 hour, and a solution of potassium iodide (11.6g) in water (70ml) was added dropwise to the mixture at 0°C. Then, the mixture was heated at 80°C for 1 hour, and to the mixture was added ethyl acetate at 0°C, and the mixture was neutralized with potassium carbonate. After separation, the organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and origin components were removed by silica gel column chromatography (ethyl acetate) to give 5-iodo-3-methylisothiazole (10.6g) as deep brown oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.51 (s, 3H), 7.15 (s, 1H).

Reference Example 220

[0416] To a solution of 5-iodo-3-methylisothiazole (10.0g) in dry tetrahydrofuran (150ml) was added dropwise n-butyllithium (33.3ml, 1.6M solution in hexane) at -78°C under nitrogen atmosphere. After 30 minutes, to the mixture was added dropwise DMF (9.7g) at -78°C under nitrogen atmosphere, the temperature was returned to room temperature, and the mixture was stirred for 2 hours. Then, to the mixture was added 1N hydrochloric acid (75ml) at 0°C, and the mixture was stirred for 30 minutes and extracted with ethyl acetate. The extract was dried with magnesium sulfate, the solvent was evaporated under reduced pressure, and the resulting residue was subjected to silica gel column chromatography (ethyl acetate) to remove origin components to give 3-methylisothiazole-5-carboxyaldehyde (5.0g) as deep brown oil.

¹H-NMR (200 MHz, CDCl₃) δ 2.59 (s, 3H), 7.54 (s, 1H), 10.08 (s, 1H).

Reference Example 221

[0417] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (500mg) and 3-methylthiazole-5-carboxyaldehyde (803mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxymethylborohydride (807mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 1 day. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue

was purified by silica gel column chromatography (hexane : ethyl acetate = 2 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(3-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-5-carboxylate (640mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.70 (m, 2H), 2.48 (s, 3H), 2.85 (t, 2H, J = 4.4 Hz), 3.34 (t, 2H, J = 4.8 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.82 (m, 5H), 4.16 (t, 2H, J = 5.0 Hz), 4.76 (s, 2H), 6.87 - 7.00 (m, 4H), 7.41 (dd, 1H, J = 8.8, 2.2 Hz), 7.47 (d, 2H, J = 8.8 Hz), 7.56 (d, 1H, J = 2.2 Hz), 7.80 (s, 1H).

Reference Example 222

[0418] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(3-methylthiazol-5-yl)methyl-2, 3-dihydro-1-benzazepine-4-carboxylate (640mg) in a mixture of tetrahydrofuran (39ml) and methanol (39ml) was added 1N sodium hydroxide solution (13ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(3-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (460mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.45 (m, 2H), 1.55 - 1.69 (m, 2H), 2.49 (s, 3H), 2.87 (t, 2H, J = 4.4 Hz), 3.37 (t, 2H, J = 4.4 Hz), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.4 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.78 (s, 2H), 6.89 - 7.01 (m, 4H), 7.40 - 7.49 (m, 3H), 7.58 (d, 1H, J = 1.8 Hz), 7.91 (s, 1H).

Anal. Calcd. C₂₈H₃₂N₂O₄S Calcd. C, 68.27; H, 6.55; N, 5.69. Found C, 67.94; H, 6.55; N, 5.97.

Reference Example 223

[0419] To a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (200mg) and pyridine (123mg) in tetrahydrofuran (10ml) was added 2-thenoyl chloride (208mg) at 0°C, and the mixture was heated at 78°C overnight. After allowing to cool, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated, which was recrystallized from hexane-ethyl acetate to give methyl 7-bromo-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (236mg) as colorless crystals.

¹H-NMR (200 MHz, CDCl₃) δ 2.98 (br, 2H), 3.82 (s, 3H), 6.73 (dd, 1H, J = 4.0, 1.0 Hz), 6.80 - 6.85 (m, 1H), 6.91 (d, 1H, 8.8), 7.26 - 7.31 (m, 1H), 7.37 (dd, 1H, J = 5.2, 1.4 Hz), 7.68 - 7.69 (m, 2H).

Anal. Calcd. C₁₇H₁₄NO₃Br Calcd. C, 52.05; H, 3.60; N, 3.57. Found C, 52.05; H, 3.45; N, 3.38.

Reference Example 224

[0420] In toluene (10ml), ethanol (1.0ml) and water (1.0ml) were suspended methyl 7-bromo-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (210mg), 4-butoxyethoxyphenyl borate (166mg) and potassium carbonate (192mg), and the mixture was stirred for 30 minutes under argon atmosphere. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (43mg), and the mixture was heated at 100°C for 5 hours under argon atmosphere. After allowing to cool, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (201mg) as colorless oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.30 - 1.45 (m, 2H), 1.50 - 1.65 (m, 2H), 3.00 (br, 2H), 3.56 (t, 2H, J = 7.0 Hz), 3.79 - 3.84 (m, 5H), 4.18 (t, 2H, J = 4.8 Hz), 6.74 - 6.82 (m, 2H), 7.02 (d, 2H, J = 8.8 Hz), 7.08 (d, 1H, J = 8.4 Hz), 7.32 - 7.40 (m, 2H), 7.54 (d, 2H, J = 8.8 Hz), 7.72 (d, 1H, J = 2.2 Hz), 7.83 (s, 1H).

Reference Example 225

[0421] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (200mg) in a mixture of tetrahydrofuran (12ml) and methanol (12ml) was added 1N sodium hydroxide solution (4ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-(2-thienylcarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (171mg) as yellow crystals. ¹H-NMR (200 MHz, CDCl₃) δ 0.94 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.70 (m, 2H), 3.02 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.82 (t, 2H, J = 4.4 Hz), 4.18 (t, 2H, J = 5.0 Hz), 6.72 - 6.83 (m, 2H), 7.02 (d, 2H, J = 8.8 Hz), 7.09 (d, 1H, J = 8.4 Hz), 7.34 - 7.42 (m, 2H),

7.54 (d, 2H, J = 8.8 Hz), 7.74 (d, 1H, J = 2.2 Hz), 7.92 (s, 1H).
 Anal. Calcd. $C_{28}H_{29}O_3S$ Calcd. C, 68.41; H, 5.95; N, 2.85. Found C, 68.18; H, 6.03; N, 2.84.

Reference Example 226

[0422] To a suspension of 60% sodium hydride (2.3g) in tetrahydrofuran (40ml) which had been washed with hexane three times was added a solution of 4-bromopyrazole (7.0g) in tetrahydrofuran (40ml) at 0°C under nitrogen atmosphere, the temperature was returned room temperature, and the mixture was stirred for 1 hour. To this mixture was added dropwise a solution of ethyl iodide (8.9g) in tetrahydrofuran (30ml) at 0°C under nitrogen atmosphere, the temperature was returned to room temperature, and the mixture was stirred overnight. The solution was diluted with tetrahydrofuran, and the insolubles were filtered using Celite. The filtrate was concentrated under reduced pressure, hexane was added thereto, and the insolubles were filtered. The filtrate was concentrated under reduced pressure to give 4-bromo-1-ethylpyrazole (7.72g) as light yellow liquid.
 1H -NMR (200 MHz, $CDCl_3$) δ 1.48 (t, 3H, J = 7.8 Hz), 4.16 (q, 2H, J = 7.4 Hz), 7.41 (s, 1H), 7.45 (s, 1H).

Reference Example 227

[0423] To a solution of 4-bromo-1-ethylpyrazole (7.0g) in dry tetrahydrofuran (150ml) was added dropwise n-butyllithium (30ml, 1.6M solution in hexane) at -78°C under nitrogen atmosphere. After 30 minutes, to the mixture was added dropwise DMF (14.6g) at -78°C under nitrogen atmosphere, the temperature was returned to room temperature, and the mixture was stirred for 1 hour. Then, to the mixture was added 1N hydrochloric acid (60ml) at 0°C, and the mixture was stirred for 30 minutes, which was made basic with 1N sodium hydroxide solution, and the mixture was extracted with ethyl acetate five times. The extract was dried with magnesium sulfate, the solvent was evaporated under reduced pressure, and the resulting residue was subjected to silica gel column chromatography (hexane : ethyl acetate = 1 : 2) to give 1-ethylpyrazole-4-carboxyaldehyde (2.9g) as light yellow oil.
 1H -NMR (200 MHz, $CDCl_3$) δ 1.54 (t, 3H, J = 7.2 Hz), 4.24 (q, 2H, J = 7.4 Hz), 7.95 (s, 1H), 7.97 (s, 1H), 9.86 (s, 1H).

Reference Example 228

[0424] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 1-ethylpyrazole-4-carboxyaldehyde (471mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxyborohydride (804mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 2 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane:ethyl acetate=1:1) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-5-carboxylate (382mg) as yellow oil.
 1H -NMR (200 MHz, $CDCl_3$) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.70 (m, 7H), 2.76 (br, 2H), 3.27 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.39 - 3.83 (m, 5H), 4.07 - 4.29 (m, 4H), 4.42 (s, 2H), 6.94 - 7.00 (m, 3H), 7.33 - 7.54 (m, 6H), 7.79 (s, 1H).

Reference Example 229

[0425] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (382mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (287mg) as yellow crystals.
 1H -NMR (200 MHz, $CDCl_3$) δ 0.93 (t, 3H, J = 7.2 Hz), 1.34 - 1.65 (m, 7H), 2.78 (br, 2H), 3.29 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 5.2 Hz), 4.11 - 4.22 (m, 4H), 4.44 (s, 2H), 6.95 - 7.01 (m, 3H), 7.34 (s, 1H), 7.41 - 7.50 (m, 4H), 7.56 (d, 1H, J = 2.2 Hz), 7.79 (s, 1H).
 Anal. Calcd. $C_{29}H_{35}N_3O_4$ Calcd. C, 71.14; H, 7.21; N, 8.58. Found C, 70.84; H, 7.47; N, 8.48.

Reference Example 230

[0426] To a solution of ethyl 2-methyldioxolan-2-ylacetate (2.0g) in methanol (69ml) was added 1N sodium hydroxide solution (23ml), and the mixture was stirred at room temperature overnight. Then, the mixture was neutralized with 1N hydrochloric acid, and the solvent was evaporated under reduced pressure. To the mixture was added ethyl acetate,

and the mixture was dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give 2-methyldioxolan-2-ylacetic acid (1.63g) as colorless amorphous.

¹H-NMR (200 MHz, CDCl₃) δ 1.51 (s, 3H), 2.74 (s, 2H), 4.03 (s, 4H).

5 Reference Example 231

[0427] To a solution of 5-(2-hydroxyethyl)-4-methylthiazole (2.5g) in dichloromethane (125ml) was added Celite (10.0g), and to the mixture was added PCC (18.9g), which was stirred for 2 hours under nitrogen atmosphere. The insolubles were filtered, followed by washing with ether.

10 [0428] The solvent was evaporated under reduced pressure, and the residue was subjected to Florisil column chromatography (ethyl acetate) to remove origin components, and the residue was recrystallized from hexane-ethyl acetate to give 4-methylthiazole-5-carboxyaldehyde (692mg).

¹H-NMR (200 MHz, CDCl₃) δ 2.80 (s, 3H), 8.98 (s, 1H), 10.15 (s, 1H).

15 Reference Example 232

[0429] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 4-methylthiazole-5-carboxyaldehyde (482mg) in 1,2-dichloroethane (15ml) was added sodium triacetoxyborohydride (804mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 6 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(4-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-5-carboxylate (284mg) as yellow oil.

20 ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.4 Hz), 1.34 - 1.45 (m, 2H), 1.50 - 1.70 (m, 2H), 2.50 (s, 3H), 2.76 (t, 2H, J = 5.2 Hz), 3.26 (t, 2H, J = 5.2 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 4.4 Hz), 4.65 (s, 2H), 6.93 (d, 1H, J = 8.8 Hz), 6.98 (d, 2H, J = 9.2 Hz), 7.41 - 7.50 (m, 3H), 7.56 (d, 1H, J = 2.6 Hz), 7.78 (s, 1H), 8.66 (s, 1H).

Reference Example 233

30 [0430] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(4-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (284mg) in a mixture of tetrahydrofuran (18ml) and methanol (18ml) was added 1N sodium hydroxide solution (6ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate.

35 The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(4-methylthiazol-5-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (201mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.2 Hz), 1.30 - 1.50 (m, 2H), 1.50 - 1.70 (m, 2H), 2.51 (s, 3H), 2.79 (br, 2H), 3.29 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 4.8 Hz), 4.17 (t, 2H, J = 5.2 Hz), 4.67 (s, 2H), 6.92 - 7.01 (m, 3H), 7.43 - 7.50 (m, 3H), 7.58 (d, 1H, J = 2.6 Hz), 7.89 (s, 1H), 8.68 (s, 1H).

40 Anal. Calcd. C₂₈H₃₂N₂O₄ Calcd. C, 68.27; H, 6.55; N, 5.69. Found C, 67.95; H, 6.56; N, 5.63.

Reference Example 234

45 [0431] To a mixture (135.0g) of methyl 7-bromo-1-[(4-methylphenyl)sulfonyl]-oxo-2,3,4,5-tetrahydro-1-benzazepine-4-carboxylate and ethyl 7-bromo-1-[(4-methylphenyl)sulfonyl]-oxo-2,3,4,5-tetrahydro-1-benzazepine-4-carboxylate in tetrahydrofuran (1200ml) was added sodium borohydride (11.1g) at -65°C, and to the mixture was added dropwise methanol (120ml). After completion of the addition, the mixture was stirred at -15°C to 25°C for 1.5 hours, to the mixture was added dropwise acetone (67.8g, 1.17mol) at -25°C, and the mixture was further stirred for 30 minutes.

50 To the mixture were added ethyl acetate and water at -45°C, which was separated, and the organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give brown oil (152.3g). The oil was dissolved in dry tetrahydrofuran (1000ml) as it was, and to the solution was added dropwise methanesulfonyl chloride (50.1g) at 0°C under nitrogen atmosphere. After completion of the addition, the mixture was stirred at room temperature for 1 hour, and to the mixture was added dropwise DBU (66.6g), which was stirred for 5 hours.

55 To the mixture was added water, the mixture was extracted with ethyl acetate, and the organic layer was washed with 1N hydrochloric acid twice and further with water and saturated brine, followed by drying with magnesium sulfate. The solvent was evaporated under reduced pressure to give brown oil (148g). This was dissolved in acetic acid (520ml), to the solution was added concentrated sulfuric acid (260ml, 4.88mol) at 0°C, and the mixture was heated at 90°C for

3 hours. After allowing to cool, to the mixture was added water (40ml), and the mixture was heated again at 90°C for 2.5 hours. After allowing to cool, the solvent was evaporated under reduced pressure. Ice was added to the resulting residue, and 6N sodium hydroxide solution was added to pH = 4. The precipitated solid was collected by filtration, and the solid was dissolved in 1N sodium hydroxide solution (1500ml). The insolubles were removed by filtration, and dichloric acid was added to the filtrate to adjust to pH = 4 at 0°C, and the precipitated solid was collected by filtration. The solid was dried under reduced pressure to give 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylic acid (69.4g) as green solid.

¹H-NMR (200 MHz, DMSO-d₆) δ 2.36 (t, 2H, J = 4.8 Hz), 2.87 (t, 2H, J = 4.8 Hz), 6.35 (d, 1H, J = 8.6, 2.6 Hz), 6.84 (dd, 1H, J = 8.6, 2.6 Hz), 7.08 (d, 1H, J = 2.6 Hz), 7.12 (s, 1H).

Reference Example 235

[0432] To a suspension of 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylic acid (68.2g) in methanol (100ml) was added concentrated sulfuric acid (37.3g) at 0°C, and the mixture was heated at 80°C for 10 hours. After allowing to cool, the solvent was evaporated under reduced pressure. Ethyl acetate and water were added thereto and 1N sodium hydroxide solution was added to pH=4 at 0°C. The solution was separated, and the organic phase was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, the resulting residue was subjected to silica gel column to remove origin components (ethyl acetate), and the resulting solid was washed with diisopropyl ether to give methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (44.0g). The filtrate was purified with silica gel column (hexane : ethyl acetate = 4 : 1) to give methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (3.4g).

¹H-NMR (200 MHz, CDCl₃) δ 2.86 (t, 2H, J = 5.2 Hz), 3.36 (t, 2H, J = 5.2 Hz), 3.80 (s, 3H), 4.57 (br, 1H), 6.49 (d, 1H, J = 8.4 Hz), 7.15 (dd, 1H, J = 8.4, 2.2 Hz), 7.38 (d, 1H, J = 2.2 Hz), 7.53 (s, 1H).

Reference Example 236

[0433] In toluene (100ml), ethanol (10ml) and water (10ml) were suspended methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (3.0g), 4-propoxyethoxyphenyl borate (3.1g) and potassium carbonate (3.8g), and the suspension was stirred for 30 minutes under argon atmosphere. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (860mg), and the mixture was heated at 100°C for 8 hours under argon atmosphere. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was subjected to silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give the solid, which was washed with hexane to give methyl 7-(4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (2.59g) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 1.56 - 1.74 (2H, m), 2.88 (2H, t, J = 4.8 Hz), 3.41 (2H, t, J = 4.8 Hz), 3.51 (2H, t, J = 7.0 Hz), 3.78 - 3.83 (m, 5H), 4.16 (2H, t, J = 4.8 Hz), 6.66 (1H, d, J = 8.0 Hz), 6.97 (2H, d, J = 6.68 Hz), 7.31 (1H, dd, J = 8.0, 2.2 Hz), 7.43 - 7.47 (3H, m), 7.725 (1H, s).

Reference Example 237

[0434] In toluene (200ml) and ethanol (35ml) were suspended methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (5.0g), 4-butoxyethoxyphenyl borate (4.6g) and 1M potassium carbonate solution (35ml), and the mixture was stirred for 30 minutes under argon atmosphere. Then, to the mixture was added tetrakis(triphenylphosphine)palladium (1.0g), and the mixture was heated at 100°C overnight under argon atmosphere. After allowing to cool, to the mixture was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 4 : 1) to give the solid, which was washed with hexane to give methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (5.7g) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.29 - 1.49 (2H, m), 1.55 - 1.68 (2H, m), 2.86 - 2.95 (2H, m), 3.41 - 3.45 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.68 (1H, d, J = 8.6 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.34 (1H, d, J = 8.6, 2.0 Hz), 7.43 - 7.48 (3H, m), 7.85 (1H, s).
C₂₃H₂₇NO₄ Calcd. C, 72.42; H, 7.13; N, 3.67. Found C, 72.32; H, 7.01; N, 3.84.

Reference Example 238

[0435] To a suspension of 60% sodium hydride (4.2g) in tetrahydrofuran (40ml) which had been washed with hexane three times was added dropwise a solution of 4-bromopyrazole (7.0g) in tetrahydrofuran (50ml) at 0°C under nitrogen

atmosphere, the temperature was returned to room temperature, and the mixture was stirred for 1 hour. To the mixture was added dropwise a solution of ethyl iodide (17.8g) in tetrahydrofuran (30ml) at 0°C under nitrogen atmosphere and the mixture was refluxed for 1 day. The solution was diluted with tetrahydrofuran, and the insolubles were filtered using Celite. After the filtrate was concentrated under reduced pressure, hexane was further added, and the insolubles were removed by filtration. The filtrate was concentrated under reduced pressure, followed by distillation under reduced pressure to give 4-bromo-1-isopropylpyrazole (5.8g) as light yellow liquid.

¹H-NMR (200 MHz, CDCl₃) δ 1.50 (d, 6H, J = 6.6 Hz), 4.40 - 4.54 (m, 1H), 7.43 (s, 1H), 7.45 (s, 1H).

Reference Example 239

[0436] To a solution of 4-bromo-1-isopropylpyrazole (5.0g) in dry ether (75ml) was added dropwise n-butyllithium (22ml, 1.6M solution in hexane) at -78°C under nitrogen atmosphere. After 30 minutes, to the mixture was added dropwise DMF (9.7g) at -78°C under nitrogen atmosphere, the temperature was returned to room temperature and the mixture was stirred for 1 hour. Then, to the mixture was added 1N hydrochloric acid (40ml) at 0°C, and the mixture was stirred for 30 minutes, made basic with 1N sodium hydroxide solution, extracted with ethyl acetate five times and dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give 1-isopropylpyrazole-4-carboxyaldehyde (3.6g) as light yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.55 (d, 6H, J = 6.6 Hz), 4.48 - 4.61 (m, 1H), 7.98 (s, 2H), 9.86 (s, 1H).

Reference Example 240

[0437] To a solution of methyl 7-(4-butoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (300mg) and 1-isopropylpyrazole-4-carboxyaldehyde (524mg) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (964mg), and the mixture was stirred under nitrogen atmosphere at room temperature for 4 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 3 : 1) to give methyl 7-(4-butoxyethoxyphenyl)-1-[(1-isopropylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-5-carboxylate (392mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.65 (m, 10H), 2.75 (t, 2H, J = 5.0 Hz), 3.26 (t, 2H, J = 5.0 Hz), 3.55 (t, 2H, J = 6.6 Hz), 3.78 - 3.83 (m, 5H), 4.16 (t, 2H, J = 4.8 Hz), 4.42 (s, 2H), 4.44 - 4.61 (m, 1H), 6.94 - 7.00 (m, 3H), 7.36 - 7.50 (m, 5H), 7.55 (d, 1H, J = 2.6 Hz), 7.79 (s, 1H).

Reference Example 241

[0438] To a solution of methyl 7-(4-butoxyethoxyphenyl)-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (392mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 3 days. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, which was recrystallized from hexane-ethyl acetate to give 7-(4-butoxyethoxyphenyl)-1-[(1-isopropylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (229mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (t, 3H, J = 7.0 Hz), 1.34 - 1.45 (m, 2H), 1.50 (d, 6H, J = 6.6 Hz), 1.53 - 1.68 (m, 2H), 2.77 (br, 2H), 3.29 (br, 2H), 3.56 (t, 2H, J = 6.6 Hz), 3.81 (t, 2H, J = 5.2 Hz), 4.16 (t, 2H, J = 5.0 Hz), 4.43 - 4.52 (m, 3H), 6.96 - 7.00 (m, 3H), 7.36 - 7.55 (m, 6H), 7.89 (s, 1H).

Anal. Calcd. C₃₀H₃₇N₃O₄ Calcd. C, 71.54; H, 7.40; N, 8.34. Found C, 71.16; H, 7.24; N, 8.23.

Reference Example 242

[0439] To a solution of methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (800mg) and 1-ethylpyrazole-4-carboxyaldehyde (1.05g) in 1,2-dichloroethane (30ml) were added sodium triacetoxymethylborohydride (3.0g) and acetic acid (853mg) and the mixture was stirred under nitrogen atmosphere at room temperature for 2 days. Then, water was added to the mixture, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 7-bromo-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-5-carboxylate (593mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.48 (t, 3H, J = 6.6 Hz), 2.73 (t, 2H, J = 4.8 Hz), 3.22 (t, 2H, J = 4.8 Hz), 3.80 (s, 3H), 4.15 (q, 2H, J = 7.4 Hz), 4.36 (s, 2H), 6.77 (d, 1H, J = 8.8 Hz), 7.22 - 7.29 (m, 2H), 7.42 (s, 1H), 7.45 (d, 1H, J = 2.2 Hz), 7.60 (s, 1H).

Reference Example 243

[0440] In toluene (15ml), ethanol (1.5ml) and water (1.5ml) were suspended methyl 7-bromo-1-[(1-ethylpyrazol-4-yl)methyl]-2,3-dihydro-1-benzazepine-4-carboxylate (550mg), 4-propoxyethoxyphenyl borate (320mg) and potassium carbonate (506mg), and the suspension was stirred for 30 minutes under argon atmosphere. Then, to the suspension was added tetrakis(triphenylphosphine)palladium (81mg), and the mixture was heated at 100°C for 6 hours under argon atmosphere. After allowing to cool, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane : ethyl acetate = 1 : 1) to give methyl 1-[(1-ethylpyrazol-4-yl)methyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (370mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.06 (t, 3H, J = 7.6 Hz), 1.48 (t, 3H, J = 7.4 Hz), 1.75 - 1.95 (m, 2H), 2.76 (t, 2H, J = 5.4 Hz), 3.27 (t, 2H, J = 5.4 Hz), 3.81 (s, 3H), 3.96 (t, 2H, J = 6.6 Hz), 4.16 (q, 2H, J = 7.4 Hz), 4.42 (s, 2H), 6.93 - 6.97 (m, 3H), 7.33 (s, 1H), 7.38 - 7.49 (m, 4H), 7.54 (d, 1H, J = 2.4 Hz), 7.79 (s, 1H).

Reference Example 244

[0441] To a solution of methyl 1-[(1-ethylpyrazol-4-yl)methyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (370mg) in a mixture of tetrahydrofuran (24ml) and methanol (24ml) was added 1N sodium hydroxide solution (8ml), and the mixture was stirred at room temperature for 1 day. Then, to the mixture was added water at 0°C, and 1N hydrochloric acid was further added to neutral, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure to give 1-[(1-ethylpyrazol-4-yl)methyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (330mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.06 (t, 3H, J = 7.6 Hz), 1.49 (t, 3H, J = 7.4 Hz), 1.78 - 1.89 (m, 2H), 2.78 (br, 2H), 3.30 (br, 2H), 3.96 (t, 2H, J = 6.6 Hz), 4.16 (q, 2H, J = 7.4 Hz), 4.44 (s, 2H), 6.93 - 6.99 (m, 3H), 7.34 (s, 1H), 7.40 - 7.50 (m, 4H), 7.56 (d, 1H, J = 2.2 Hz), 7.89 (s, 1H).

Reference Example 245

[0442] In methanol (25ml) and THF (10ml) was dissolved methyl 7-[(4-(2-butoxyethoxy)phenyl)-1-(2-methylthiazol-4-yl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.17g). To the solution was added 1N sodium hydroxide solution (4ml), and the mixture was stirred at room temperature overnight, heated at 60°C for 5 hours, concentrated, neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with anhydrous magnesium sulfate. The solvent was evaporated to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methylthiazol-4-yl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.12g) as yellow crystals.

mp 155 - 158°C.
¹H-NMR (δ ppm, CDCl₃) 0.94 (3H, t, J = 7.2 Hz), 1.31 - 1.49 (2H, m), 1.55 - 1.69 (2H, m), 2.67 (3H, s), 2.87 (2H, t-like), 3.56 (2H, t, J = 6.6 Hz), 3.82 (2H, t, J = 4.9 Hz), 3.96 (2H, t-like), 4.17 (2H, t, J = 4.9 Hz), 5.97 (1H, s), 7.00 (2H, d, J = 8.6 Hz), 7.44 (2H, s), 7.51 (2H, d, J = 8.6 Hz), 7.63 (1H, s), 7.88 (1H, s).
IR (KBr) ν: 2926, 1674, 1530, 1495 cm⁻¹.

Reference Example 246

[0443] In THF (6.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.30g). To the solution was added 60% sodium hydride (61mg) under ice-cooling and the mixture was stirred at room temperature for 1 hour. To the mixture was added crotyl bromide (0.31ml), and the mixture was stirred at 60°C for 4 days. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 4/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-crotyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.23g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.65 (2H, m), 1.75 (3H, d, J = 5.2 Hz), 2.71 - 2.82 (2H, m), 3.22 - 3.27 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.77 - 3.82 (2H, m), 3.81 (3H, s), 3.88 (2H, d, J = 4.4 Hz), 5.22 (1H, m), 5.63 (1H, m), 6.85 - 7.01 (3H, m), 7.36 - 7.49 (4H, m), 7.77 (1H, s).

Reference Example 247

[0444] In THF (4.4ml)/methanol (4.4ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-crotyl-2,3-dihydro-

1-benzazepine-4-carboxylate (0.22g). To the solution was added 1N sodium hydroxide solution (2.2ml), and the mixture was stirred at 40°C for 6 hours. pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate=8/1 to give 7-[4-(2-butoxyethoxy)phenyl]-1-crotyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (198mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.34 - 1.45 (2H, m), 1.54 - 1.65 (2H, m), 1.76 (3H, d, J = 5.4 Hz), 2.82 (2H, m), 3.27 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.89 (3H, s), 4.13 - 4.18 (2H, m), 5.23 (1H, m), 5.66 (1H, m), 6.88 (1H, d, J = 6.2 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.38 - 7.53 (4H, m), 7.88 (1H, s).

Working Example 83 (Production of Compound 83)

[0445] In DMF (3.9ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-crotyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.20g). To the solution was added thionyl chloride (82μl), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, and a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (111mg) and triethylamine (0.31ml) in THF (3.3ml) under ice-cooling, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate, washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from isopropyl ether/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-crotyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 83) (9mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.25 - 1.45 (2H, m), 1.53 - 1.78 (6H, m), 2.20 (3H, s), 2.68 (1H, m), 3.33 - 3.43 (4H, m), 3.55 (2H, t, J = 7.0 Hz), 3.59 (2H, s), 3.77 - 3.80 (2H, m), 3.88 (2H, m), 3.98 - 4.07 (2H, m), 4.12 - 4.18 (2H, m), 5.24 (1H, m), 5.62 (1H, m), 6.68 (3H, s), 6.90 (1H, d, J = 8.4 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.27 - 7.58 (7H, m).

Reference Example 248

[0446] Methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (2.0g) was dissolved in 1,2-dichloroethane (70ml). To the solution were added isobutylaldehyde (3.2ml) and sodium triacetoxyborohydride (5.26g), and the mixture was stirred at room temperature for 12 hours. The solvent was removed under reduced pressure, and the resulting residue was added to water and extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 6/1) to give methyl 7-bromo-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylate (1.82g). ¹H-NMR (200 MHz, CDCl₃) δ 0.92 (6H, d, J = 6.6 Hz), 2.03 (1H, m), 2.77 - 2.82 (2H, m), 3.10 (2H, d, J = 7.4 Hz), 3.21-3.26 (2H, m), 3.80 (3H, s), 6.71 (1H, d, J = 8.8 Hz), 7.19 - 7.26 (1H, m), 7.42 (1H, d, J = 2.6 Hz), 7.58 (1H, s).

Reference Example 249

[0447] In toluene/ethanol/water (= 10/1/1, 41ml) was dissolved methyl 7-bromo-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.90g). To the solution were added 4-(2-propoxyethoxy)phenyl borate (0.72g) and potassium carbonate (0.81g) and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (123mg), and the mixture was heated to reflux for 14 hours. After cooled to room temperature, the solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine, and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 8/1) to give methyl 1-isobutyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.79g).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 0.95 (6H, d, J = 6.6 Hz), 1.57 - 1.72 (2H, m), 1.98 - 2.15 (1H, m), 2.80 - 2.85 (2H, m), 3.16 (2H, d, J = 7.2 Hz), 3.27 - 3.32 (2H, m), 3.51 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.81 (3H, s), 4.13 - 4.19 (2H, m), 6.89 (1H, d, J = 8.8 Hz), 6.95 - 7.00 (2H, m), 7.39 (1H, dd, J = 8.8, 2.2 Hz), 7.43 - 7.49 (3H, m), 7.77 (1H, s).

IR (KBr) 2961, 2870, 1701, 1607, 1499, 1248, 1180, 927, 820 cm⁻¹.

Reference Example 250

[0448] In THF (15.8ml)/methanol (15.8ml) was dissolved methyl 1-isobutyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-

dro-1-benzazepine-4-carboxylate (0.79g). To the solution was added 1N sodium hydroxide solution (7.9ml) and the mixture was stirred at room temperature for 20 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 6/1) to give 1-isobutyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.57g).

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.2 Hz), 0.96 (6H, d, J = 6.6 Hz), 1.59 - 1.71 (2H, m), 2.00 - 2.17 (1H, m), 2.80 - 2.86 (2H, m), 3.19 (2H, d, J = 7.2 Hz), 3.30 - 3.35 (2H, m), 3.52 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 4.17 (2H, t, J = 4.8 Hz), 6.90 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.38 - 7.53 (4H, m), 7.89 (1H, s).

Working Example 84 (Production of Compound 84)

[0449] In THF (11.4ml) was dissolved 1-isobutyl-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.57g). To the solution was added oxalyl chloride (0.23ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.33g) and triethylamine (0.94ml) in THF (9.9ml) under ice-cooling, and the mixture was stirred at room temperature for 14 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from hexane/ethyl acetate to give 1-isobutyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 84) (0.56g).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 0.97 (6H, d, J = 6.6 Hz), 1.62 - 1.82 (6H, m), 2.00 - 2.17 (1H, m), 2.20 (3H, s), 2.64 (1H, m), 2.87 - 2.95 (2H, m), 3.18 (2H, d, J = 7.4 Hz), 3.30 - 3.43 (4H, m), 3.51 (2H, t, J = 7.0 Hz), 3.56 (2H, s), 3.78 - 3.83 (2H, m), 3.99 - 4.07 (2H, m), 4.13 - 4.19 (2H, m), 6.91 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.27 - 7.57 (10H, m). IR (KBr) 3303, 2957, 1636, 1607, 1499, 1244, 1122, 926, 812 cm⁻¹.

Anal. Calcd. C₃₉H₅₁N₃O₄ Calcd. C, 74.85; N, 6.71; H, 8.21. Found C, 74.69; N, 6.92; H, 8.34.

Reference Example 251

[0450] Methyl 7-bromo-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.90g) was dissolved in toluene/ethanol/water (=10/1/1, 41ml). To the solution were added 4-(2-butoxyethoxy)phenyl borate (0.76g) and potassium carbonate (0.18g), and the mixture was stirred under argon atmosphere for 30 minutes. To the mixture was added tetrakis(triphenylphosphine)palladium (123mg), and the mixture was heated to reflux for 14 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate=8/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.75g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 0.95 (6H, d, J = 6.6 Hz), 1.37 - 1.67 (4H, m), 2.26 (1H, m), 2.82 (2H, m), 3.17 (2H, d, J = 4.8 Hz), 3.30 (2H, t, J = 4.8 Hz), 3.55 (2H, t, J = 6.6 Hz), 3.77 - 3.83 (2H, m), 3.81 (3, s), 4.13 - 4.18 (2H, m), 6.89 (1H, d, J = 8.4 Hz), 6.94 - 7.00 (2H, m), 7.36 - 7.52 (4H, m), 7.77 (1H, s).

IR (KBr) 2959, 1703, 1607, 1499, 1244, 1181, 814 cm⁻¹.

Reference Example 252

[0451] In THF (15.0ml)/methanol (15.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.75g). To the solution was added 1N sodium hydroxide solution (7.5ml), and the mixture was stirred at room temperature for 20 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 6/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.61g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 0.96 (6H, d, J = 6.6 Hz), 1.34 - 1.47 (2H, m), 1.54 - 1.66 (2H, m), 2.08 (1H, m), 2.79 - 2.85 (2H, m), 3.19 (2H, d, J = 6.8 Hz), 3.30 - 3.35 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 4.16 (2H, J = 4.8 Hz), 6.90 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.38 - 7.53 (4H, m), 7.89 (1H, s).

Working Example 85 (Production of Compound 85)

[0452] In THF (12.0ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.60g). To the solution was added oxalyl chloride (0.24ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.33g) and triethylamine (0.96ml) in THF (9.6ml) under ice-cooling, and the mixture was stirred at room temperature for 14 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 85) (0.49g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.97 (6H, d, J = 6.6 Hz), 1.33 - 1.46 (2H, m), 1.54 - 1.77 (6H, m), 2.07 (1H, m), 2.20 (3H, s), 2.64 (1H, m), 2.88 - 2.95 (2H, m), 3.18 (2H, d, J = 7.4 Hz), 3.30 - 3.43 (4H, m), 3.51 - 3.59 (2H, m), 3.56 (2H, s), 3.77 - 3.83 (2H, m), 3.98 - 4.07 (2H, m), 4.12 - 4.18 (2H, m), 6.91 (1H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.4 Hz), 7.29 (1H, d, J = 8.4 Hz), 7.36 - 7.58 (9H, m). IR (KBr) 3303, 2955, 1636, 1597, 1499, 1242, 1121, 926, 812 cm⁻¹. Anal. Calcd. C₄₀H₅₃N₃O₄ Calcd. C, 75.08; N, 6.57; H, 8.35. Found C, 74.99; N, 6.69; H, 8.16.

20 Reference Example 253

[0453] In 1,2-dichloroethane (60ml) was dissolved methyl 7-bromo-2,3-dihydro-1-benzazepine-4-carboxylate (1.7g). To the solution were added isopentylaldehyde (3.1g) and sodium triacetoxyborohydride (4.5g), and the mixture was stirred at room temperature for 12 hours. The solvent was removed under reduced pressure, and the resulting residue was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 5/1) to give methyl 7-bromo-1-isopentyl-2,3-dihydro-1-benzazepine-4-carboxylate (1.84g).

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (6H, d, J = 6.2 Hz), 1.48 - 1.62 (3H, m), 2.79 (2H, t, J = 4.4 Hz), 3.21 (2H, t, J = 4.4 Hz), 3.24 - 3.33 (2H, m), 3.80 (3H, s), 6.68 (1H, d, J = 8.8 Hz), 7.20 - 7.26 (1H, m), 7.41 (1H, d, J = 2.2 Hz), 7.56 (1H, s).

Reference Example 254

[0454] In THF (36ml)/methanol (36ml) was dissolved methyl 7-bromo-1-isopentyl-2,3-dihydro-1-benzazepine-4-carboxylate (1.8g). To the solution was added 1N sodium hydroxide solution (18ml), and the mixture was stirred at room temperature for 24 hours. pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 6/1) to give 7-bromo-1-isopentyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (1.51g).

¹H-NMR (200 MHz, CDCl₃) δ 0.96 (6H, d, J = 6.2 Hz), 1.52 - 1.71 (3H, m), 2.78 - 2.84 (2H, m), 3.21 - 3.26 (2H, m), 3.32 (2H, d, J = 8.2 Hz), 6.69 (1H, d, J = 8.8 Hz), 7.22 - 7.29 (1H, m), 7.43 (1H, d, J = 2.2 Hz), 7.68 (1H, s).

Reference Example 255

[0455] In DMF (30ml) was dissolved 7-bromo-1-isopentyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (1.5g). To the solution was added thionyl chloride (0.84ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (1.04g) and triethylamine (3.2ml) in THF (20.8ml) under ice-cooling, and the mixture was stirred at room temperature for 16 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1) to give 7-bromo-1-isopentyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (1.35g).

¹H-NMR (200 MHz, CDCl₃) δ 0.96 (6H, d, J = 6.2 Hz), 1.54 - 1.86 (5H, m), 2.21 (3H, s), 2.66 (1H, m), 2.88 (2H, m), 3.26 (2H, m), 3.28 - 3.44 (2H, m), 3.57 (2H, s), 3.98 - 4.11 (2H, m), 6.70 (1H, d, J = 8.8 Hz), 7.18 - 7.40 (3H, m), 7.54 (2H, d, J = 8.4 Hz), 7.64 (1H, s), 8.02 (1H, s).

Working Example 86 (Production of Compound 86)

[0456] In toluene/ethanol/water (=10/1/1, 31.5ml) was dissolved 7-bromo-1-isopentyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (0.66g). To the solution were added 4-(2-propoxyethoxy)phenyl borate (0.33g) and potassium carbonate (0.37g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (56mg), and the mixture was heated to reflux for 16 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1). The purified residue was dissolved in ethyl acetate and filtered to give a solution. The solvent was removed under reduced pressure, followed by recrystallization from isopropyl ether/ethyl acetate to give 1-isopentyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 86) (80mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.4 Hz), 0.96 (6H, d, J = 6.0 Hz), 1.54 - 1.76 (6H, m), 2.21 (3H, s), 2.68 (1H, m), 2.89 (2H, m), 3.30 - 3.50 (9H, m), 3.51 (2H, t, J = 6.2 Hz), 3.58 (2H, s), 3.98 - 4.07 (2H, m), 4.15 (2H, t, J = 4.8 Hz), 6.65 (1H, s), 6.70 - 6.81 (1H, m), 6.88 (1H, d, J = 9.2 Hz), 6.96 (2H, d, J = 8.6 Hz), 7.30 - 7.69 (9H, m). IR (KBr) 3312, 2953, 2867, 1644, 1605, 1501, 1244, 829 cm⁻¹.

Working Example 87 (Production of Compound 87)

[0457] In toluene/ethanol/water (=10/1/1, 31.5ml) was dissolved 7-bromo-1-isopentyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (0.66g). To the solution were added 4-(2-butoxyethoxy)phenyl borate (0.35g) and potassium carbonate (0.37g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (56mg), and the mixture was heated to reflux for 16 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1). The purified residue was dissolved in ethyl acetate and filtered to give a solution. The solvent was removed under reduced pressure, followed by recrystallization from isopropyl ether/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-isopentyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 87) (74mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 0.98 (6H, d, J = 6.2 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.75 (6H, m), 2.21 (3H, s), 2.67 (1H, m), 2.85 - 2.92 (2H, m), 3.30 - 3.43 (9H, m), 3.55 (2H, t, J = 6.6 Hz), 3.58 (2H, s), 3.77 - 3.83 (2H, m), 4.00 - 4.06 (2H, m), 4.12 - 4.17 (2H, m), 6.66 (1H, s), 6.89 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 8.4 Hz), 7.38 - 7.63 (7H, m). IR (KBr) 3328, 2957, 2870, 1642, 1607, 1503, 1242, 1140, 823 cm⁻¹.

Reference Example 256

[0458] In THF (14.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.70g). To the solution was added 60% sodium hydride (142mg) at 0°C, and the mixture was stirred at room temperature for 1 hour. To the mixture was added 1-bromo-3-methyl-2-butene (0.83ml), and the mixture was stirred at 60°C for 60 hours. After cooled to room temperature, the mixture was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 4/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methyl-2-butenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.71g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, d, J = 7.2 Hz), 1.33-1.45 (2H, m), 1.54 - 1.68 (2H, m), 1.75 (3H, s), 1.78 (3H, s), 2.78 - 2.83 (2H, m), 3.19 - 3.25 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.77 - 3.80 (2H, m), 3.93 (2H, d, J = 6.2 Hz), 4.10 - 4.18 (2H, m), 5.32 (1H, m), 6.86 (1H, d, J = 8.4 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.37 - 7.52 (4H, m), 7.76 (1H, s).

Reference Example 257

[0459] In THF (14.0ml)/methanol (14.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methyl-2-butenyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.70g). To the solution was added 1N sodium hydroxide (7.0ml), and the mixture was stirred at room temperature for 24 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed

under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 6/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methyl-2-butenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.46g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, d, J = 7.2 Hz), 1.35 - 1.47 (2H, m), 1.54 - 1.65 (2H, m), 1.76 (3H, s), 1.79 (3H, s), 2.79 - 2.85 (2H, m), 3.21 - 3.29 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.95 (2H, d, J = 5.8 Hz), 4.13 - 4.19 (2H, m), 5.33 (1H, m), 6.87 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.38 - 7.54 (2H, m), 7.47 (2H, d, J = 8.8 Hz), 7.89 (1H, s).

Working Example 88 (Production of Compound 88)

[0460] In THF (9.0ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methyl-2-butenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.40g). To the solution was added oxalyl chloride (0.18ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.24g) and triethylamine (0.70ml) in THF (7.2ml) under ice-cooling, and the mixture was stirred at room temperature for 14 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-isobutyl-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 88) (0.33g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, d, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.67 (6H, m), 1.77 (3H, s), 1.80 (3H, s), 2.21 (3H, m), 2.65 (1H, m), 2.91 (2H, m), 3.25 - 3.44 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.80 (2H, t, J = 4.8 Hz), 3.95 (2H, d, J = 6.2 Hz), 4.00 - 4.08 (2H, m), 4.16 (2H, t, J = 4.6 Hz), 5.34 (1H, m), 6.89 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.27 - 7.56 (10H, m).

IR (KBr) 2926, 2865, 1703, 1607, 1499, 1244, 1181, 814 cm⁻¹.

Anal. Calcd. C₄₁H₅₃N₃O₄ Calcd. C, 75.54; N, 6.45; H, 8.19. Found C, 75.39; N, 6.40; H, 8.03.

Reference Example 258

[0461] In THF (228ml) was dissolved 2-ethoxyethanol (22.8g). To the solution were added triethylamine (49.3ml) and methanesulfonyl chloride (23.6ml) at 0°C, and the mixture was stirred at room temperature for 1 hour. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was added dropwise to a solution of 4-[(benzyloxycarbonyl)amino]butyric acid (30.0g) and 60% sodium hydride (10.1g) in THF (450ml). The mixture was stirred at 60°C for 16 hours, cooled to room temperature, and the reaction solution was added to water. To the mixture was added 1N sodium hydroxide (50ml), and the mixture was washed with ethyl acetate. The mixture was neutralized with 1N hydrochloric acid and extracted with ethyl acetate. The extract was washed with saturated sodium thiosulfate solution and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was dissolved in methylene chloride (54.6ml), which was added dropwise to a solution of concentrated sulfuric acid (8.23ml) and magnesium sulfate (28.3g) in methylene chloride (273ml). To the mixture was added 2-methyl-2-propanol (28.1ml), and the mixture was stirred at room temperature for 18 hours. To the mixture was added an aqueous solution of sodium hydrogen carbonate to adjust pH to approximate 8, and the mixture was extracted with ethyl acetate. The extract was washed with water and saturated brine, and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 6/1 → 5/1) to give tert-butyl 4-[(benzyloxycarbonyl)(2-ethoxyethyl)amino]butyrate (8.7g).

¹H-NMR (200 MHz, CDCl₃) δ 1.20 (3H, d, J = 7.4 Hz), 1.44 (9H, s), 1.71 - 1.82 (2H, m), 2.27 (2H, t, J = 7.2 Hz), 2.64 (2H, t, J = 7.4 Hz), 2.72 - 2.81 (2H, m), 3.50 (2H, q, J = 7.4 Hz), 3.50 - 3.56 (2H, m).

Reference Example 259

[0462] In methanol (87ml) was dissolved tert-butyl 4-[(benzyloxycarbonyl)(2-ethoxyethyl)amino]butyrate (8.7g). To the solution was added 10% palladium/carbon (0.87g), and the mixture was stirred for 3 hours under hydrogen atmosphere. 10% palladium/carbon was removed by filtration with Celite, and the solvent of the resulting solution was removed under reduced pressure to give tert-butyl 4-[(2-ethoxyethyl)amino]butyrate (5.5g).

¹H-NMR (200 MHz, CDCl₃) δ 1.26 (3H, d, J = 7.0 Hz), 1.43 (9H, s), 1.77 - 1.87 (2H, m), 2.18 - 2.27 (2H, m), 3.31 - 3.57 (6H, m), 5.13 (2H, s), 7.32 - 7.37 (5H, m).

Reference Example 260

[0463] In DMF (43.9ml) was dissolved tert-butyl 4-[(2-ethoxyethyl)amino]butyrate (5.5g). To the solution was added 5-bromo-2-fluorobenzaldehyde (4.4g), followed by addition of potassium carbonate (3.6g). The mixture was stirred at 90°C for 60 hours and cooled to room temperature. The reaction solution was added to water, the mixture was extracted with ethyl acetate, washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 6/1 → 5/1) to give tert-butyl 4-[4-bromo(2-ethoxyethyl)-2-formylanilino]butyrate (2.3g).
¹H-NMR (200 MHz, CDCl₃) δ 1.12 (3H, d, J = 7.0 Hz), 1.41 (9H, s), 1.76 - 1.81 (2H, m), 2.16 - 2.24 (2H, m), 3.23 (2H, t, J = 7.4 Hz), 3.28 - 3.39 (4H, m), 3.37 (2H, q, J = 7.0 Hz), 3.43 - 3.49 (2H, m), 7.14 (1H, d, J = 8.6 Hz), 7.59 (1H, dd, J = 8.8, 2.6 Hz), 7.91 (1H, d, J = 2.4 Hz), 10.30 (1H, s).

Reference Example 261

[0464] In toluene (4.8ml)/2-methyl-2-propanol (0.48ml) was dissolved tert-butyl 4-[4-bromo(2-ethoxyethyl)-2-formylanilino]butyrate (2.4g). To the solution was added potassium tert-butoxide (72mg), the mixture was stirred at 100°C for 1 hour and cooled to room temperature. The reaction solution was added to water, the mixture was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 6/1) to give tert-butyl 7-bromo-1-(2-ethoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.15g).
¹H-NMR (200 MHz, CDCl₃) δ 1.21 (3H, t, J = 7.0 Hz), 1.53 (9H, s), 2.76 (2H, t, J = 4.4 Hz), 3.26 (2H, t, J = 4.4 Hz), 3.44 - 3.54 (2H, m), 3.52 (2H, q, J = 7.0 Hz), 3.62 - 3.69 (2H, m), 6.82 (1H, d, J = 8.8 Hz), 7.22 (1H, dd, J = 8.8, 2.6 Hz), 7.39 (1H, d, J = 2.2 Hz), 7.46 (1H, s).

Reference Example 262

[0465] In ethyl acetate (22ml) was dissolved tert-butyl 7-bromo-1-(2-ethoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.1g). To the solution was added 4N hydrochloric acid/ethyl acetate (11ml) at room temperature, and the mixture was stirred for 24 hours. An aqueous saturated solution of sodium hydrogen carbonate was added to adjust pH to approximate 4, followed by extraction with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 7-bromo-1-(2-ethoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.73g).
¹H-NMR (200 MHz, CDCl₃) δ 1.21 (3H, t, J = 7.0 Hz), 2.82 (2H, t, J = 4.4 Hz), 3.30 (2H, t, J = 4.4 Hz), 3.51 (2H, t, J = 4.4 Hz), 3.52 (2H, q, J = 7.0 Hz), 3.67 (2H, t, J = 5.2 Hz), 6.85 (1H, d, J = 8.8 Hz), 7.23 - 7.29 (1H, m), 7.44 (1H, d, J = 2.2 Hz), 7.69 (1H, s).

Reference Example 263

[0466] In DMF (14.6ml) was dissolved 7-bromo-1-(2-ethoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.73g). To the solution was added thionyl chloride (0.39ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.53g) and triethylamine (1.5ml) in THF (15.9ml) under ice-cooling, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, the mixture was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol=3/1) to give 7-bromo-1-(2-ethoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (0.66g).
¹H-NMR (200 MHz, CDCl₃) δ 1.21 (3H, t, J = 7.0 Hz), 1.63 - 1.82 (4H, m), 2.20 (3H, s), 2.64 (1H, m), 2.87 - 2.96 (4H, m), 3.31 - 3.38 (4H, m), 3.47 - 3.58 (2H, m), 3.56 (2H, s), 3.64 - 3.70 (2H, m), 3.97 - 4.09 (2H, m), 6.85 (1H, d, J = 8.8 Hz), 7.19 - 7.32 (4H, m), 7.40 (1H, d, J = 2.6 Hz), 7.50 - 7.56 (2H, m), 8.01 (1H, s).

Working Example 89 (Production of Compound 89)

[0467] In toluene/ethanol/water (= 20/1/1, 14.3ml) was dissolved 7-bromo-1-(2-ethoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (0.32g). To the solution were added 4-(2-propoxyethoxy)phenyl borate (0.16g) and potassium carbonate (0.18g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (27mg), and the mixture

ture was heated to reflux for 14 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1). The purified residue was dissolved in ethyl acetate, which was filtered to give a solution. The solvent was removed under reduced pressure, which was recrystallized from isopropyl ether/ethyl acetate to give 1-(2-ethoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 89) (60mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 1.59 - 1.80 (6H, m), 2.21 (3H, s), 2.65 (1H, m), 2.92 (2H, m), 3.22 - 3.69 (8H, m), 3.57 (2H, s), 3.69 - 3.73 (2H, m), 3.78 - 3.84 (2H, m), 3.99 - 4.17 (2H, m), 4.16 (2H, t, J = 4.8 Hz), 6.69 (1H, s), 6.95 - 7.03 (3H, m), 7.30 - 7.56 (9H, m).

Working Example 90 (Production of Compound 90)

[0468] In toluene/ethanol/water (= 20/1/1, 14.3ml) was dissolved 7-bromo-1-(2-ethoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (0.32g). To the solution were added 4-(2-butoxyethoxy)phenyl borate (0.17g) and potassium carbonate (0.18g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (27mg), and the mixture was heated to reflux for 14 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1). The purified residue was dissolved in ethyl acetate, which was filtered to give a solution. The solvent was removed under reduced pressure, which was recrystallized from isopropyl ether/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 90) (15mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.23 (3H, t, J = 7.0 Hz), 1.29 - 1.45 (2H, m), 1.54 - 1.75 (6H, m), 2.21 (3H, s), 2.65 (1H, m), 2.92 (2H, m), 3.30 - 3.44 (4H, m), 3.50 - 3.60 (4H, m), 3.57 (2H, s), 3.67 - 3.72 (2H, m), 3.98 - 4.07 (2H, m), 4.13 - 4.18 (2H, t, J = 4.8 Hz), 6.70 (1H, s), 6.95 - 7.03 (3H, m), 7.27 - 7.55 (9H, m).

Reference Example 264

[0469] In THF (400ml) was dissolved 2-methoxyethanol (20g). To the solution were added triethylamine (47.6ml), 4-dimethylaminopyridine (9.66g) and p-toluenesulfonyl chloride (60.2g), and the mixture was stirred at room temperature for 2 hours. The mixture was stirred at 60°C for 3 hours, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, the resulting residue was added dropwise to a solution of 4-[(benzyloxycarbonyl)amino]butyric acid (30.2g) and 60% sodium hydride (10.2g) in THF (453ml). The mixture was stirred at 65°C for 24 hours and cooled to room temperature. The reaction solution was added to water, followed by addition of 1N sodium hydroxide (50ml) and washing with ethyl acetate. The mixture was neutralized with 1N hydrochloric acid, and extracted with ethyl acetate. The extract was washed with saturated sodium thiosulfate solution and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was dissolved in methylene chloride (90ml), which was added dropwise to a solution of concentrated sulfuric acid (5.4ml) and magnesium sulfate (48.9g) in methylene chloride (450ml). To the mixture was added 2-methyl-2-propanol (48.6ml), and the mixture was stirred at room temperature for 18 hours. An aqueous saturated solution of sodium hydrogen carbonate was added to adjust pH to approximate 8, which was extracted with ethyl acetate. The extract was washed with water and saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 6/1 → 5/1) to give tert-butyl 4-[(benzyloxycarbonyl)(2-methoxyethyl)amino]butyrate (10.7g).

¹H-NMR (200 MHz, CDCl₃) δ 1.43 (9H, s), 1.75 - 1.87 (2H, m), 2.27 (2H, t, J = 7.2 Hz), 3.18 - 3.58 (9H, m), 5.13 (2H, s).

Reference Example 265

[0470] In methanol (300ml) was dissolved tert-butyl 4-[(benzyloxycarbonyl)(2-methoxyethyl)amino]butyrate (30.0g). To the solution was added 10% palladium/carbon (3.0g), and the mixture was stirred for 3 hours under hydrogen atmosphere. 10% palladium/carbon was removed by filtration with Celite, the solvent was removed under reduced pressure, and the resulting residue was added dropwise to a solution of 5-bromo-2-fluorobenzaldehyde (15.8g) and sodium carbonate (9.9g) in DMF (186ml). The mixture was stirred at 90°C for 65 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure,

and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 4/1) to give tert-butyl 4-[4-bromo(2-methoxyethyl)-2-formylanilino]butyrate (6.0g). Tert-butyl 4-[4-bromo(2-methoxyethyl)-2-formylanilino]butyrate (6.0g) was dissolved in toluene (60ml)/2-methyl-2-propanol (6.0ml). To the solution was added potassium tert-butoxide (1.85g), and the mixture was stirred at 100°C for 1 hour. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate=5/1) to give tert-butyl 7-bromo-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepinecarboxylate (1.8g).

¹H-NMR (200 MHz, CDCl₃) δ 1.53 (9H, s), 2.75 (2H, t, J = 4.4 Hz), 3.24 (2H, t, J = 4.8 Hz), 3.39 (3H, s), 3.55 - 3.65 (4H, m), 6.73 (1H, d, J = 9.0 Hz), 7.19 - 7.40 (3H, m), 7.46 (1H, s).

Reference Example 266

[0471] In toluene/ethanol/water (= 10/1/1, 62.4ml) was dissolved tert-butyl 7-bromo-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.8g). To the solution were added 4-(2-butoxyethoxy)phenyl borate (1.68g) and potassium carbonate (1.55g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenylphosphine)palladium (0.22g), and the mixture was heated to reflux for 16 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 5/1) to give tert-butyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.4g). ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.54 (9H, s), 1.53 - 1.65 (2H, m), 2.75 - 2.80 (2H, m), 3.32 (2H, m), 3.41 (3H, s), 3.49 - 3.58 (4H, m), 3.63 - 3.67 (2H, m), 3.72 - 3.83 (2H, m), 4.13 - 4.18 (2H, m), 6.78 (1H, d, J = 5.4 Hz), 6.87 (2H, d, J = 8.8 Hz), 7.38 (1H, dd, J = 8.4, 2.2 Hz), 7.43 - 7.48 (3H, m), 7.65 (1H, s).

Reference Example 267

[0472] In ethyl acetate (28ml) was dissolved tert-butyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.4g). To the solution was added 4N hydrochloric acid/ethyl acetate (14ml) at room temperature, and the mixture was stirred at 60°C for 2 hours. After cooled to room temperature, an aqueous saturated solution of sodium hydrogen carbonate was added to adjust pH to approximate 5. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 6/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.61g, 49%). ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.66 (2H, m), 2.84 (2H, m), 3.34 - 3.44 (2H, m), 3.41 (3H, s), 3.56 (2H, t, J = 6.6 Hz), 3.52 - 3.59 (2H, m), 3.65 - 3.71 (2H, m), 4.13 - 4.18 (2H, m), 6.98 (2H, d, J = 8.4 Hz), 7.00 (1H, d, J = 8.8 Hz), 7.40 - 7.50 (4H, m), 7.89 (1H, s).

Working Example 91 (Production of Compound 91)

[0473] In THF (12.0ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.60g). To the solution was added oxalyl chloride (0.24ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.33g) and triethylamine (0.95ml) in THF (9.9ml) under ice-cooling, and the mixture was stirred at room temperature for 14 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methoxyethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 91) (0.57g). ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.30 - 1.45 (2H, m), 1.54 - 1.76 (2H, m), 2.20 (3H, s), 2.64 (1H, m), 2.91 (2H, m), 3.30 - 3.41 (2H, m), 3.41 (3H, s), 3.51 - 3.59 (2H, m), 3.56 (2H, s), 3.65 - 3.71 (2H, m), 3.77 - 3.83 (2H, m), 4.00 - 4.17 (2H, m), 4.15 (2H, t, J = 4.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 6.99 (1H, d, J = 8.4 Hz), 7.30 (1H, d, J = 8.8 Hz), 7.39 - 7.56 (9H, m). IR (KBr) 3321, 2922, 1640, 1609, 1501, 1244, 1140, 822 cm⁻¹.

Reference Example 268

[0474] In THF (12.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxy-

late (0.60g). To the solution were added pyridine (0.37ml) and 4-dimethylaminopyridine (56mg), followed by addition of crotonic anhydride (0.58ml). The mixture was stirred at 50°C for 24 hours, and cooled to room temperature. The reaction solution was added to water and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 3/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-[(E)-2-butenoyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.53g).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.0 Hz), 1.34 - 1.46 (2H, m), 1.55 - 1.66 (2H, m), 3.52 - 3.60 (2H, t, J = 6.2 Hz), 3.79 - 3.85 (2H, m), 3.83 (3H, s), 4.15 - 4.21 (2H, m), 4.94 - 5.11 (1H, m), 5.88 - 6.04 (1H, m), 7.02 (2H, d, J = 8.8 Hz), 7.24 - 7.29 (1H, m), 7.53 (3H, d, J = 8.4 Hz), 7.66 (1H, s), 7.74 (1H, s).

Reference Example 269

[0475] In THF (10.6ml)/methanol (10.6ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-[(E)-2-butenoyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.53g). To the solution was added 1N sodium hydroxide (5.3ml), and the mixture was stirred at room temperature for 20 hours. pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-[(E)-2-butenoyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.40g).

¹H-NMR (200 MHz, CDCl₃) δ 0.97 (3H, t, J = 6.8 Hz), 1.31 - 1.50 (2H, m), 1.54 - 1.63 (2H, m), 1.80 (3H, d, J = 6.4 Hz), 3.57 (2H, t, J = 6.6 Hz), 3.82 (2H, m), 4.19 (2H, m), 4.90 (1H, m), 6.01 (1H, m), 7.03 (2H, d, J = 8.4 Hz), 7.21 (1H, d, J = 8.4 Hz), 7.52 - 7.57 (3H, m), 7.67 (1H, s), 7.84 (1H, s).

Working Example 92 (Production of Compound 92)

[0476] In THF (7.8ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-[(E)-2-butenoyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.39g). To the solution were added DMF (two droplets) and oxalyl chloride (0.15ml), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (210mg) and triethylamine (0.60ml) in THF (6.3ml) under ice-cooling, and the mixture was stirred at room temperature for 14 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol=4/1), which was recrystallized from isopropyl ether/ethyl acetate to give 1-[(E)-2-butenoyl]-7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 92) (168mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 1.25 - 1.49 (2H, m), 1.54 - 1.82 (9H, m), 2.21 (3H, s), 2.65 (1H, m), 2.93 (3H, s), 3.16 - 3.43 (3H, m), 3.52 - 3.60 (2H, m), 3.56 (2H, s), 3.79 - 3.85 (2H, m), 3.98 - 4.09 (2H, m), 4.91 (1H, m), 6.00 - 6.09 (1H, m), 7.03 (2H, d, J = 8.8 Hz), 7.18 - 7.33 (3H, m), 7.39 - 7.67 (8H, m).

IR (KBr) 2936, 2851, 1659, 1609, 1495, 1250, 1140, 826 cm⁻¹.

Anal. Calcd. C₄₀H₄₉N₃O₅·0.7H₂O Calcd. C, 72.51; H, 6.32; N, 7.65. Found C, 72.33; H, 6.05; N, 7.42.

Reference Example 270

[0477] 4N sodium hydroxide (36ml) was added to 1-isopropyl-2-pyrrolidone (9.2g), and the mixture was stirred for 3.5 hours. After cooled to 0°C, the mixture was neutralized with concentrated hydrochloric acid. After sodium carbonate (15.3g) was added thereto, a solution of 5-bromo-2-fluorobenzaldehyde (7.3g) in dimethyl sulfoxide (96ml) was added thereto, and the mixture was heated to reflux for 5 hours. After cooled to room temperature, pH was adjusted to approximate 4 with 6N hydrochloric acid, and the mixture was extracted with ethyl acetate/THF. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 4/1 → 3/2) to give 4-(4-bromo-2-formylisopropylanilino)butyric acid (0.92g).

¹H-NMR (200 MHz, CDCl₃) δ 1.12 (6H, d, J = 6.6 Hz), 1.74 (2H, m), 2.37 (2H, t, J = 7.0 Hz), 3.16 (2H, t, J = 6.6 Hz), 3.30 (1H, m), 7.12 (1H, d, J = 8.8 Hz), 7.60 (1H, d, J = 8.8, 2.4 Hz), 7.95 (1H, d, J = 2.4 Hz), 10.21 (1H, s).

Reference Example 271

[0478] In DMF (4.5ml) was dissolved 4-(4-bromo-2-formylisopropylanilino)butyric acid (0.9g). To the solution was added potassium carbonate (0.49g), followed by addition of methyl iodide (0.2ml) and stirring at room temperature 1

hour. To the mixture was added dimethyl carbonate (9ml), followed by addition of a 28% sodium methoxide/methanol solution (1.27g) and stirring at 50°C for 1 hour. After cooled to room temperature, the mixture was neutralized with 2N hydrochloric acid, and extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 20/1 → 8/1) to give methyl 7-bromo-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g).

¹H-NMR (200 MHz, CDCl₃) δ 1.24 (6H, d, J = 6.6 Hz), 2.73 - 2.79 (2H, m), 3.15 (2H, t, J = 4.8 Hz), 3.80 (3H, s), 3.98 (1H, s), 6.70 (1H, d, J = 9.0 Hz), 7.22 (1H, d, J = 2.6 Hz), 7.42 (1H, d, J = 2.6 Hz), 7.55 (1H, s).

Reference Example 272

[0479] In toluene/ethanol/water (= 10/1/1, 20.4ml) was dissolved methyl 7-bromo-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g). To the solution were added 4-(2-butoxyethoxy)phenyl borate (0.48g) and potassium carbonate (0.47g), and the mixture was stirred for 30 minutes under argon atmosphere. To the mixture was added tetrakis(triphenyl)phosphinepalladium (0.10g), and the mixture was heated to reflux for 14 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 20/1 → 8/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.44g). Methyl 7-[4-(2-butoxyethoxy)phenyl]-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylate (0.44g) was dissolved in THF (8.8ml)/methanol (8.8ml). To the solution was added 1N sodium hydroxide (4.4ml), and the mixture was stirred at 50°C for 4 hours. After cooled to room temperature, pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate/THF, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (12/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (320mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.28 (6H, d, J = 6.6 Hz), 1.28 - 1.68 (4H, m), 2.77 - 2.83 (2H, m), 3.20 - 3.26 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 4.11 (1H, m), 4.13 - 4.18 (2H, m), 6.90 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.4 Hz), 7.25 - 7.54 (4H, m), 7.87 (1H, s).

Working Example 93 (Production of Compound 93)

[0480] In THF (6.4ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-isopropyl-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.32g), followed by addition of DMF (two droplets). To the mixture was added oxalyl chloride (165μl), and the mixture was stirred at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (183mg) and triethylamine (0.63ml) in THF (5.5ml) under ice-cooling, and the mixture was stirred at room temperature for 3 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-isopropyl-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 93) (284mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.29 (6H, d, J = 6.6 Hz), 1.32 - 1.54 (2H, m), 1.57 - 1.76 (6H, m), 2.20 (3H, s), 2.64 (1H, s), 2.89 (2H, m), 3.24 - 3.43 (4H, m), 3.55 (2H, t, J = 6.2 Hz), 3.56 (2H, s), 3.80 (2H, m), 4.00 - 4.08 (2H, m), 4.10 (1H, m), 4.16 (2H, m), 6.92 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.29 (2H, d, J = 8.8 Hz), 7.40 - 7.56 (8H, m).

IR (KBr) 2959, 2870, 1667, 1597, 1514, 1497, 1404, 1242, 820 cm⁻¹.

Anal. Calcd. C₃₉H₅₁N₃O₄·0.5H₂O Calcd. C, 73.78; N, 6.62; H, 8.26. Found C, 74.04; N, 6.53; H, 8.41.

Reference Example 273

[0481] In THF (27.4ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (1.37g). To the solution was added 60% sodium hydride (0.27g) at 0°C, and the mixture was stirred at room temperature for 1 hour. To the mixture was added 3-bromo-1-(trimethylsilyl)-1-propyne (1.48ml), and the mixture was stirred at 65°C for 90 hours. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography. (hexane/ethyl acetate = 3/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-trimethylsilyl-2-propynyl)-

2,3-dihydro-1-benzazepine-4-carboxylate (0.78g).

¹H-NMR (200 MHz, CDCl₃) δ 0.18 (9H, s), 0.93 (3H, t, J = 7.4 Hz), 1.34 - 1.44 (2H, m), 1.55 - 1.64 (2H, m), 2.82 - 2.90 (2H, m), 3.33 - 3.40 (4H, m), 3.56 (2H, t, J = 6.2 Hz), 3.78 - 3.84 (2H, m), 3.82 (3H, s), 4.07 (2H, s), 4.10 - 4.19 (2H, m), 6.97 - 7.06 (3H, m), 7.43 (4H, m), 7.76 (1H, s).

Reference Example 274

[0482] In THF (7.8ml)/methanol (7.8ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-trimethylsilyl-2-propynyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.78g). To the solution was added 2N potassium hydroxide (7.8ml), and the mixture was stirred at room temperature for 16 hours. pH was adjusted to approximate 4 with 6N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-propynyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.52g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.34 - 1.47 (2H, m), 1.55 - 1.68 (2H, m), 2.31 (1H, m), 2.84 - 2.95 (2H, m), 3.37 - 3.43 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.84 (2H, m), 4.08 (2H, d, J = 2.2 Hz), 4.14 - 4.19 (2H, m), 6.99 (2H, d, J = 8.8 Hz), 7.06 (1H, d, J = 8.8 Hz), 7.45 - 7.56 (4H, m), 7.87 (1H, s).

Reference Example 94 (Production of Compound 94)

[0483] In THF (10.4ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2-propynyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.52g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (0.27ml) and stirring at room temperature for 2 hours. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (0.30g) and triethylamine (1.04ml) in THF (9.0ml) under ice-cooling, and the mixture was stirred at room temperature for 15 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1), which was recrystallized from ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-1-(2-propynyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 94) (570mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.33 - 1.46 (2H, m), 1.54 - 1.75 (6H, m), 2.20 (3H, s), 2.32 (1H, m), 2.64 (1H, m), 2.90 - 2.97 (2H, m), 3.30 - 3.42 (6H, m), 3.51 - 3.59 (2H, m), 3.55 (2H, s), 3.77 - 3.83 (2H, m), 4.00 - 4.17 (4H, m), 4.06 (1H, m), 6.97 (2H, d, J = 8.8 Hz), 7.05 (2H, d, J = 8.8 Hz), 7.31 - 7.56 (8H, m), 7.67 (1H, s). IR (KBr) 3322, 3249, 2948, 1642, 1607, 1499, 1240, 1140, 810 cm⁻¹.

Anal. Calcd. C₃₉H₄₇N₃O₄ Calcd. C, 75.33; N, 6.76; H, 7.62. Found C, 75.39; N, 6.74; H, 7.53.

Reference Example 275

[0484] In THF (24.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (1.20g). To the solution was added 60% sodium hydride (0.24g), and the mixture was stirred at room temperature for 1 hour. To the mixture was added 1-bromo-2-butyne (0.80ml), and the mixture was stirred at 65°C for 4 days. After cooled to room temperature, the reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 4/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-butyryl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.30 - 1.45 (2H, m), 1.53 - 1.68 (2H, m), 1.83 - 1.86 (3H, m), 2.83 - 2.89 (2H, m), 3.30 - 3.38 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.84 (2H, m), 3.81 (3H, s), 4.01 (2H, d, J = 2.2 Hz), 4.13 - 4.18 (2H, m), 6.98 (2H, d, J = 8.8 Hz), 7.04 (1H, d, J = 8.8 Hz), 7.42 - 7.54 (4H, m), 7.76 (1H, s).

Reference Example 276

[0485] In THF (5.0ml)/methanol (5.0ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-butyryl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g). To the solution was added 2N potassium hydroxide (5.0ml), and the mixture was stirred at 50°C for 3 hours. pH was adjusted to approximate 4 with 6N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-butyryl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.40g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.35 - 1.45 (2H, m), 1.55 - 1.64 (2H, m), 1.86 (3H, s), 2.88 (2H, m), 3.38 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.84 (2H, m), 4.02 (2H, d, J = 2.0 Hz), 4.17 (2H, t, J = 4.8 Hz), 6.98 (2H, d, J = 8.6 Hz), 7.05 (1H, d, J = 8.4 Hz), 7.44 - 7.55 (4H, m), 7.87 (1H, s).
IR (KBr) 2922, 1677, 1607, 1503, 1275, 1248, 1192, 924, 806 cm⁻¹.

Working Example 95 (Production of Compound 95)

[0486] In THF (8.0ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2-butyryl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.40g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (0.20ml) and stirring at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (224mg) and triethylamine (0.64ml) in THF (6.7ml) under ice-cooling, and the mixture was stirred at room temperature for 12 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1 → 3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-butyryl)-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 95) (359mg).
m.p 129 - 131°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.26 - 1.48 (2H, m), 1.54 - 1.76 (6H, m), 1.86 (23H, s), 2.21 (3H, s), 2.64 (1H, m), 2.96 (2H, m), 3.30 - 3.44 (4H, m), 3.55 (2H, t, J = 6.2 Hz), 3.56 (2H, s), 3.80 (2H, t, J = 4.8 Hz), 4.00 - 4.10 (4H, m), 4.13 - 4.18 (2H, m), 6.98 (2H, d, J = 8.8 Hz), 7.07 (2H, d, J = 8.8 Hz), 7.30 (2H, m), 7.39 - 7.58 (8H, m).
IR (KBr) 2953, 1655, 1605, 1514, 1499, 1244, 1138, 814 cm⁻¹.
Anal. Calcd. C₄₀H₄₉N₃O₄ Calcd. C, 75.56; N, 6.61; H, 7.77. Found C, 75.53; N, 6.52; H, 7.79.

Reference Example 277

[0487] In THF (11.2ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.56g). To the solution were added pyridine (0.17ml) and ethyl chloroformate (0.18ml), and the mixture was stirred at room temperature for 3 hours. To the mixture was added 4-dimethylaminopyridine (169mg), and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 3/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(ethoxycarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (580mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.26 (4H, m), 1.55 - 1.62 (2H, m), 2.93 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.66 - 3.84 (4H, m), 3.83 (3H, s), 4.14 - 4.29 (4H, m), 7.00 (2H, d, J = 8.8 Hz), 7.47 - 7.59 (5H, m), 7.73 (1H, s).

Reference Example 278

[0488] In THF (8.7ml)/methanol (8.7ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(ethoxycarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.58g). To the solution was added 1N sodium hydroxide (8.7ml), and the mixture was stirred at 50°C for 4 hours. pH was adjusted to approximate 4 with 6N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(ethoxycarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.46g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.29 (3H, t, J = 6.6 Hz), 1.56 - 1.66 (2H, m), 2.95 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.75 - 3.85 (4H, m), 4.17 (2H, t, J = 4.8 Hz), 4.23 (2H, q, J = 6.6 Hz), 7.01 (2H, d, J = 8.4 Hz), 7.51 - 7.62 (5H, m), 7.84 (1H, s).

Working Example 96 (Production of Compound 96)

[0489] In THF (9.2ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(ethoxycarbonyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.46g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (0.22ml) and stirring at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (246mg) and triethylamine (0.71ml) in THF (7.4ml) under ice-cooling, and the mixture was stirred at room temperature for 12 hours.

The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1 → 3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(ethoxycarbonyl)-4-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 96) (0.48g).
m.p 152 - 154°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.29 (3H, t, J = 6.4 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.75 (6H, m), 2.21 (3H, s), 2.65 (1H, m), 3.00 (2H, m), 3.30 - 3.43 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.81 (2H, m), 4.00 - 4.20 (2H, m), 4.17 (2H, t, J = 4.8 Hz), 4.23 (2H, q, J = 6.4 Hz), 7.00 (2H, d, J = 8.8 Hz), 7.31 (2H, d, J = 8.8 Hz), 7.46 - 7.60 (8H, m).

IR (KBr) 3308, 2955, 2870, 1699, 1609, 1497, 1250, 1208, 1140, 922, 826, 731 cm⁻¹.

Anal. Calcd. C₃₈H₄₈N₃O₆ Calcd. C, 71.00; N, 6.54; H, 7.53. Found C, 71.14; N, 6.26; H, 7.36.

Reference Example 279

[0490] In pyridine (4.3ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.43 g). To the solution was added allyl chloroformate (0.23ml), and the mixture was stirred at room temperature for 14 hours. To the mixture was added 4-dimethylaminopyridine (40mg), and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine, and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 3/1) to give methyl 1-(allyloxycarbonyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.30g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.28 - 1.45 (2H, m), 1.54 - 1.66 (2H, m), 2.94 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.85 (4H, m), 3.83 (3H, s), 4.15 - 4.19 (2H, m), 4.67 (1H, m), 5.24 (1H, m), 5.94 (1H, m), 7.00 (2H, d, J = 8.8 Hz), 7.43 - 7.60 (5H, m), 7.73 (1H, s).

Reference Example 280

[0491] In THF (4.5ml)/ethanol (4.5ml) was dissolved methyl 1-(allyloxycarbonyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.30g). To the solution was added 1N sodium hydroxide (3.0ml), and the mixture was stirred at room temperature for 4 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give 1-(allyloxycarbonyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.25g).

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.2 Hz), 1.30 - 1.49 (2H, m), 1.54 - 1.69 (2H, m), 2.97 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.75 - 3.87 (4H, m), 4.18 (2H, d, J = 4.8 Hz), 4.68 (1H, m), 5.24 (1H, m), 5.96 (1H, m), 7.01 (2H, d, J = 8.4 Hz), 7.49 - 7.61 (5H, m), 7.85 (1H, s).

Working Example 97 (Production of Compound 97)

[0492] In THF (4.8ml) was dissolved 1-(allyloxycarbonyl)-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.24g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (0.11ml) and stirring at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (125mg) and triethylamine (0.36ml) in THF (5.0ml) under ice-cooling, and the mixture was stirred at room temperature for 12 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 4/1 → 3/1), which was recrystallized from hexane/ethyl acetate to give 1-(allyloxycarbonyl)-7-[4-(2-butoxyethoxy)phenyl]-4-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 97) (0.23g).
mp 160 - 162°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.49 (2H, m), 1.54 - 1.75 (6H, m), 2.21 (3H, s), 2.65 (1H, m), 3.02 (2H, m), 3.37 (2H, td, J = 11.0, 2.8 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.81 (2H, m), 3.99 - 4.08 (2H, m), 3.99 - 4.08 (2H, m), 4.14 - 4.20 (2H, m), 4.67 (1H, m), 5.25 (1H, m), 5.92 (1H, m), 7.00 (2H, d, J = 8.4 Hz), 7.31 (2H, d, J = 8.4 Hz), 7.47 - 7.58 (9H, m).

IR (KBr) 3353, 2953, 2845, 1686, 1658, 1611, 1533, 1316, 1206, 1086, 922, 829, 764 cm⁻¹.

Anal. Calcd. C₄₀H₄₉N₃O₆ Calcd. C, 71.94; N, 6.29; H, 7.40. Found C, 71.69; N, 6.33; H, 7.49.

Reference Example 281

[0493] In 1,2-dichloroethane (15ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-benzazepine-4-carboxylate (0.50g). To the solution were added 1,3-thiazole-5-carbaldehyde (0.43g) and sodium triacetoxyborohydride (0.80g), and the mixture was stirred at room temperature for 24 hours. To the mixture was added sodium triacetoxyborohydride (0.27g), and the mixture was stirred for 6 hours. The solvent was removed under reduced pressure, the resulting residue was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate 3/2 → 2/3) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.34 - 1.44 (2H, m), 1.54 - 1.65 (2H, m), 2.79 (2H, m), 3.30 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.81 (3H, s), 4.16 (2H, m), 6.94 - 7.10 (3H, m), 7.39 - 7.57 (3H, m), 7.56 (1H, d, J = 2.2 Hz), 7.79 (1H, s), 7.83 (1H, s), 8.78 (1H, s).

Reference Example 282

[0494] In THF (5.0ml)/methanol (10ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.50g). To the solution was added 1N sodium hydroxide solution (5.0ml), and the mixture was stirred at room temperature for 16 hours. pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate/THF, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane ethyl acetate (8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (385mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.34 - 1.44 (2H, m), 1.55 - 1.67 (2H, m), 2.82 (2H, m), 3.33 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 4.17 (2H, m), 4.77 (2H, s), 6.97 (1H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.41 - 7.50 (3H, m), 7.58 (1H, d, J = 1.8 Hz), 7.85 (1H, s), 7.91 (1H, s), 8.81 (1H, s).

Working Example 98 (Production of Compound 98)

[0495] In methylene chloride (19ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.38g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (90μl) and stirring at room temperature for 2 hours to give a solution, which was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (198mg) and triethylamine (2.75ml) in methylene chloride (7.6ml), and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with methylene chloride. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 2/1) to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-1-(1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 98) (190mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.30 - 1.48 (2H, m), 1.53 - 1.72 (2H, m), 2.21 (3H, s), 2.66 (1H, m), 2.87 (2H, m), 3.30 - 3.43 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.80 (2H, m), 3.97 - 4.09 (2H, m), 4.16 (2H, m), 4.77 (2H, m), 6.98 (4H, d, J = 8.8 Hz), 7.27 - 7.58 (9H, m), 7.84 (1H, s), 8.79 (1H, s).
IR (KBr) 3293, 2955, 1645, 1609, 1518, 1499, 1406, 1242, 1140, 821 cm⁻¹.

Reference Example 283

[0496] In ethanol (50ml) was dissolved acetyl thioamide (5.0g). To the solution was added ethyl 2-chloroacetoacetate (11.0g), and the mixture was heated to reflux for 16 hours. After cooled to room temperature, the solvent was removed under reduced pressure, the resulting residue was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 1/1) to give ethyl 2,3-dimethyl-1,3-thiazole-5-carboxylate (9.1g).

¹H-NMR (200 MHz, CDCl₃) δ 1.36 (3H, t, J = 7.2 Hz), 2.68 (3H, m), 2.69 (3H, s), 4.32 (2H, q, J = 7.2 Hz).

Reference Example 284

[0497] A solution of ethyl 2,4-dimethyl-1,3-thiazole-5-carboxylate (5.0g) in THF (50ml) was added dropwise to a solution of aluminum lithium hydride (1.1g) in THF (150ml) under ice-cooling. After stirred at room temperature for 4

hours, water (1.1ml), 15% sodium hydroxide solution (1.1ml) and water (3.3ml) were added thereto, and the mixture was stirred for 10 minutes. The mixture was filtered with Celite, and washed with methanol. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 1/2) to give (2,4-dimethyl-1,3-thiazol-5-yl)methanol (2.0g).

5 ¹H-NMR (200 MHz, CDCl₃) δ 2.31 (3H, s), 2.62 (3H, s), 3.14 (1H, br), 4.72 (2H, d, J = 5.0 Hz).

Reference Example 285

10 [0498] In THF (20ml) was dissolved (2,4-dimethyl-1,3-thiazol-5-yl)methanol (1.0g). To the solution was added active manganese dioxide (6.0g), and the mixture was stirred at room temperature for 3 hours. To the mixture was added active manganese dioxide (3.0g), and the mixture was stirred at room temperature for 1 hour. The mixture was filtered with Celite and washed with methanol. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate/methanol = 10/10/1) to give 2,4-dimethyl-1,3-thiazole-5-carbaldehyde (0.32g).

15 ¹H-NMR (200 MHz, CDCl₃) δ 2.70 (3H, s), 2.73 (3H, s), 10.13 (1H, s).

Reference Example 286

20 [0499] In 1,2-dichloroethane (21ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-benzazepine-4-carboxylate (0.70g). To the solution were added 2,4-dimethyl-1,3-thiazole-5-carbaldehyde (0.62g) and sodium triacetoxymethylborohydride (1.5g), and the mixture was stirred at room temperature for 36 hours. After stirred at 60°C for 12 hours, the mixture was cooled to room temperature, and the solvent was removed under reduced pressure. The residue was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate = 1/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2,4-dimethyl-1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.26g).

25 ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.37 - 1.44 (2H, m), 1.54 - 1.67 (2H, m), 2.40 (3H, s), 2.62 (3H, s), 2.76 (2H, t, J = 4.4 Hz), 3.24 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.81 (3H, s), 4.16 (2H, m), 4.56 (2H, s), 6.93 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.39 - 7.49 (3H, m), 7.55 (1H, d, J = 2.2 Hz), 7.78 (1H, s).

Reference Example 287

30 [0500] In THF (5.0ml)/methanol (2.5ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2,4-dimethyl-1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.25g). To the solution was added 1N sodium hydroxide solution (2.5ml), and the mixture was stirred at room temperature for 16 hours. pH was adjusted to approximate 5 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate/THF, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2,4-dimethyl-1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (190mg).

40 ¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.32 - 1.46 (2H, m), 1.56 - 1.68 (2H, m), 2.42 (3H, s), 2.64 (3H, s), 2.78 (2H, m), 3.27 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 4.17 (2H, t, J = 4.8 Hz), 4.59 (2H, s), 6.92 - 7.10 (3H, m), 7.42 - 7.50 (3H, m), 7.57 (1H, d, J = 1.8 Hz), 7.89 (1H, s).
IR (KBr) 2924, 1684, 1607, 1501, 1235, 1126, 968, 810 cm⁻¹.

Working Example 99 (Production of Compound 99)

50 [0501] In methylene chloride (9.5ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2,4-dimethyl-1,3-thiazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.19g). To the solution was added DMF (two droplets), followed by addition of thionyl chloride (32μl) and stirring at room temperature for 2 hours, to give a solution, which was added dropwise to a solution of 4-[methyl(tetrahydropyran-4-yl)aminomethyl]aniline (91mg) and triethylamine (1.0ml) in methylene chloride (5.6ml), and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with methylene chloride. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 2/1), which was recrystallized from hexane/ethylacetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2,4-dimethyl-1,3-thiazol-5-ylmethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 99) (135mg).

mp 125 - 128°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.37 - 1.45 (2H, m), 1.57 - 1.77 (6H, m), 2.21 (3H, s), 2.43 (3H, s), 2.64 (3H, s), 2.84 (2H, m), 3.28 - 3.44 (2H, m), 3.52 - 3.59 (2H, m), 3.55 (2H, s), 3.81 (2H, t, J = 4.8 Hz), 3.98 - 4.08 (2H, m), 4.16 (2H, t, J = 4.8 Hz), 4.59 (2H, s), 6.96 (1H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.40 - 7.56 (8H, m).

IR (KBr) 3227, 2959, 1655, 1603, 1499, 1406, 1315, 1248, 1177, 820 cm⁻¹.

Anal. Calcd. C₄₂H₅₂N₄O₄·0.5H₂O Calcd. C, 70.26; N, 7.80; H, 7.44. Found C, 70.36; N, 7.47; H, 7.54.

Reference Example 288

[0502] To a solution of aluminum lithium hydride (2.5g) in THF (282ml) was added dropwise a solution of ethyl tetrazole-5-carboxylate (9.4g) in THF (94ml) under ice-cooling. The mixture was stirred at room temperature for 3 hours, followed by addition of water (2.5ml), 15% sodium hydroxide solution (2.5ml) and water (7.5ml), and stirring for 10 minutes. The mixture was filtered with Celite and washed with methanol. The solvent was removed under reduced pressure, and the resulting residue was dissolved in DMF (190ml). To the solution was added active manganese dioxide (37g), and the mixture was stirred at room temperature for 16 hours. The mixture was filtered with Celite and washed with methanol. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (=1/1) to give tetrazole-5-carbaldehyde (4.6g).

¹H-NMR (200 MHz, DMSO-d₆) δ 10.10 (1H, s).

Reference Example 289

[0503] In 1,2-dichloroethane (14ml)/acetic acid (7ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1-benzazepine-4-carboxylate (0.70g). To the solution were added tetrazole-5-carbaldehyde (0.31g) and sodium triacetoxyborohydride (1.5g), and the mixture was stirred at 40°C for 18 hours. The mixture was cooled to room temperature, and the solvent was removed under reduced pressure. The resulting residue was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine, and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 15/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.67g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.36 - 1.45 (2H, m), 1.55 - 1.66 (2H, m), 2.74 (2H, m), 3.33 (2H, m), 3.59 (2H, t, J = 6.6 Hz), 3.67 (3H, s), 3.83 (2H, t, J = 4.6 Hz), 4.15 (2H, m), 4.85 (2H, s), 6.79 (1H, d, J = 8.6 Hz), 6.88 (2H, d, J = 8.6 Hz), 7.27 - 7.37 (3H, m), 7.45 (1H, d, J = 2.0 Hz), 7.68 (1H, s).

Reference Example 290

[0504] In THF (6.7ml)/methanol (6.7ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.25g). To the solution was added 1N sodium hydroxide solution (6.7ml), and the mixture was stirred at 50°C for 4 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate/THF, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (2/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.45g).

¹H-NMR (200 MHz, DMSO-d₆) δ 0.89 (3H, t, J = 7.2 Hz), 1.04 - 1.55 (4H, m), 2.72 (2H, m), 3.33 (2H, m), 3.46 (2H, t, J = 6.6 Hz), 3.72 (3H, s), 4.11 (2H, t, J = 4.6 Hz), 4.91 (2H, s), 6.91 - 7.00 (3H, m), 7.43 - 7.71 (5H, m).

Working Example 100 (Production of Compound 100)

[0505] In THF (8.1ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.27g). To the solution was added DMF (two droplets), followed by addition of thionyl chloride (51μl) and stirring at room temperature for 1 hour, to give a solution, which was added dropwise to a solution of 4-[methyl(tetrahydropyran-4-yl)aminomethyl]aniline (145mg) and triethylamine (1.62ml) in THF (8.1ml) under ice-cooling, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was dissolved in ethanol. To the solution was added ethyl acetate, and the precipitates were collected by filtration, which was recrystallized from hexane/ethanol to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 100) (42mg).

¹H-NMR (200 MHz, DMSO-d₆) δ 0.89 (3H, t, J = 7.2 Hz), 1.28 - 1.39 (2H, m), 1.47 - 1.55 (2H, m), 1.55 - 1.92 (4H, m),

2.28 - 2.38 (1H, m), 2.34 (3H, s), 2.83 (2H, m), 3.24 - 3.45 (4H, m), 3.46 (2H, t, J = 6.4 Hz), 3.71 (2H, m), 3.86 - 3.99 (4H, m), 4.11 (2H, m), 4.81 (2H, s), 6.58 (1H, d, J = 8.8 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.11 (2H, d, J = 8.4 Hz), 7.33 - 7.75 (7H, m), 9.89 (1H, s).

5 Reference Example 291

[0506] In acetonitrile (100ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-4-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.0g). To the solution were added potassium carbonate (0.87g) and methyl iodide (0.31ml), and the mixture was stirred at room temperature for 4 hours. The solvent was concentrated to half under reduced pressure, which was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 8/1) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.33g) and methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.44g).

¹H-NMR (1-methyl compound; 200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.30 - 1.44 (2H, m), 1.45 - 1.66 (2H, m), 2.59 (2H, m), 3.55 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 4.8 Hz), 3.95 (3H, s), 4.16 (2H, t, J = 4.8 Hz), 4.86 (2H, s), 6.96 (1H, d, J = 8.4 Hz), 6.99 (2H, d, J = 8.8 Hz), 7.26 - 7.48 (3H, m), 7.57 (1H, d, J = 2.2 Hz), 7.78 (1H, s). ¹H-NMR (2-methyl compound; 200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.22 - 1.44 (2H, m), 1.55 - 1.65 (2H, m), 2.86 (2H, m), 3.42 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.77 - 3.83 (2H, m), 3.81 (3H, s), 4.15 (2H, t, J = 4.8 Hz), 4.36 (23H, s), 4.75 (2H, s), 6.97 (2H, d, J = 8.2 Hz), 7.13 (1H, d, J = 8.8 Hz), 7.39 - 7.54 (3H, m), 7.78 (1H, s).

Reference Example 292

[0507] In THF (6.4ml)/methanol (3.2ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.32g). To the solution was added 1N sodium hydroxide solution (3.2ml), and the mixture was stirred at room temperature for 14 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate/THF, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (5/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(1-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.25g).

¹H-NMR (200 MHz, DMSO-d₆) δ 0.89 (3H, t, J = 7.2 Hz), 1.27 - 1.41 (2H, m), 1.44 - 1.57 (2H, m), 2.69 (2H, m), 3.32 (2H, m), 3.47 (2H, t, J = 6.6 Hz), 3.72 (2H, m), 4.03 (3H, s), 4.09 (2H, m), 4.96 (2H, s), 6.87 - 6.99 (3H, m), 7.43 (1H, d, J = 8.8 Hz), 7.53 - 7.63 (3H, m), 7.71 (1H, s).

IR (KBr) 2957, 2932, 1667, 1609, 1505, 1435, 1273, 1244, 1119, 828, 797 cm⁻¹.

Working Example 101 (Production of Compound 101)

[0508] In THF (6.9ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(1-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (230mg). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (63ml) and stirring at room temperature for 1 hour, to give a solution, which was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]aniline (120mg) and triethylamine (1.34ml) in THF (6.9ml) under ice-cooling, and the mixture was stirred at room temperature for 3 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-1-(1-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 101) (114mg). mp 132 - 135°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.31 - 1.46 (2H, m), 1.56 - 1.81 (6H, m), 2.20 (3H, s), 2.54 - 2.73 (3H, m), 2.95 (2H, m), 3.30 - 3.42 (4H, m), 3.51 - 3.59 (2H, t, J = 6.2 Hz), 3.56 (2H, s), 3.78 - 3.84 (2H, m), 3.96 - 4.17 (2H, m), 3.98 (3H, s), 4.15 (2H, t, J = 4.8 Hz), 4.81 (2H, s), 6.96 (2H, d, J = 8.4 Hz), 6.98 (1H, d, J = 8.4 Hz), 7.40 - 7.58 (7H, m), 7.70 (1H, s).

IR (KBr) 3294, 2932, 1659, 1607, 1516, 1501, 1406, 1360, 1244, 1138, 820 cm⁻¹.

Anal. Calcd. C₃₉H₄₉N₇O₄ Calcd. C, 68.90; N, 14.42; H, 7.26. Found C, 68.82; N, 14.14; H, 7.08.

Reference Example 293

[0509] In THF (4.3ml)/methanol (3.2ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.43g). To the solution was added 1N sodium hydroxide solution (4.3ml), and the mixture was stirred at room temperature for 14 hours. pH was adjusted to approximate 4 with 1N hydrochloric acid, and the solvent was concentrated to half under reduced pressure. The concentrated material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (= 5/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.37g).
¹H-NMR (200 MHz, DMSO-d₆) δ 0.89 (3H, t, J = 7.2 Hz), 1.27 - 1.41 (2H, m), 1.43 - 1.58 (2H, m), 2.76 (2H, m), 3.33 (2H, m), 3.47 (2H, t, J = 6.6 Hz), 3.69 - 3.74 (2H, m), 4.07 - 4.12 (2H, m), 4.37 (3H, s), 4.81 (2H, s), 6.97 (2H, d), 7.06 (1H, d, J = 8.8 Hz), 7.42 - 7.60 (4H, m), 7.70 (1H, s).
 IR (KBr) 3034, 2934, 1672, 1607, 1501, 1404, 1246, 1190, 1132, 816 cm⁻¹.

Working Example 102 (Production of Compound 102)

[0510] In THF (10.2ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.34mg). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (93ml) and stirring at room temperature for 1 hour, to give a solution, which was added dropwise to a solution of 4-[methyl(tetrahydropyran-4-yl)aminomethyl]aniline (177mg) and triethylamine (1.98ml) in THF (10.2ml) under ice-cooling, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-1-(2-methyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 102) (193mg).
¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.32 - 1.45 (2H, m), 1.57 - 1.76 (6H, m), 2.21 (3H, s), 2.65 (1H, m), 2.95 (2H, m), 3.30 - 3.48 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.77 - 3.83 (2H, m), 3.98 - 4.08 (2H, m), 4.10 - 4.18 (2H, m), 4.37 (3H, s), 4.78 (2H, s), 6.97 (2H, d, J = 8.8 Hz), 7.05 (1H, d, J = 8.4 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.39 - 7.56 (8H, m).
 IR (KBr) 3312, 2930, 1644, 1607, 1503, 1406, 1360, 1242, 1140, 810 cm⁻¹.

Working Example 103 (Production of Compound 103)

[0511] To a solution of 1-(3-methoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (250mg) in THF (10ml) were added thionyl chloride (0.083ml) and DMF (one droplet) at room temperature, and the mixture was stirred for 1.5 hours. The solvent was evaporated under reduced pressure, and the resulting residue was dissolved in THF (15ml), which was added dropwise to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (138mg) and triethylamine (0.48ml) in THF (3ml) at 0°C. The mixture was stirred at room temperature for 3 hours, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was purified with column chromatography (ethanol : ethyl acetate 1 : 4 → 1 : 3 → 1 : 2), and the resulting crystals were purified by recrystallization (hexane-ethyl acetate) to give 1-(3-methoxypropyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 103) (264mg) as yellow crystals.
 mp 87 - 90°C.
¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.5 Hz), 1.53 - 1.82 (6H, m), 1.90 - 2.06 (2H, m), 2.21 (3H, s), 2.51 - 2.74 (1H, m), 2.86 - 2.97 (2H, m), 3.28 - 3.66 (15H, m), 3.81 (2H, t, J = 4.9 Hz), 3.98 - 4.11 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.95 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.38 - 7.57 (8H, m).
 IR (KBr) 3233, 1638, 1607, 1516, 1501, 1314, 1246, 1186, 1117 cm⁻¹.
 Anal. Calcd. C₃₉H₅₁N₃O₅ Calcd. C, 72.98; H, 8.01; N, 6.55. Found C, 72.65; H, 7.98; N, 6.35.

Working Example 104 (Production of Compound 104)

[0512] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (200mg) in THF (10ml) were added thionyl chloride (0.064ml) and DMF (one droplet) at room temperature, and the mixture was stirred for 1 hour. The solvent was evaporated under reduced pressure, and the resulting residue

was dissolved in THF (15ml), which was added dropwise to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (107mg) and triethylamine (0.37ml) in THF (5ml) at 0°C. The mixture was stirred at room temperature for 18 hours, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was purified with column chromatography (ethanol : ethyl acetate = 1 : 3), and the resulting crystals were purified by recrystallization (hexane-ethyl acetate) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxypropyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 104) (264.2mg) as yellow crystals.

mp 87 - 90°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.32 - 1.46 (2H, m), 1.50 - 1.82 (6H, m), 1.89 - 2.03 (2H, m), 2.21 (3H, s), 2.55 - 2.72 (1H, m), 2.84 - 2.96 (2H, m), 3.28 - 3.61 (15H, m), 3.80 (2H, t, J = 4.8 Hz), 3.98 - 4.09 (2H, m), 4.16 (2H, t, J = 4.8 Hz), 6.95 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.31 (2H, d, J = 8.4 Hz), 7.36 - 7.57 (8H, m). IR (KBr) 3334, 1640, 1609, 1516, 1503, 1314, 1244, 1184, 1119 cm⁻¹.

Anal. Calcd. C₄₀H₅₃N₃O₅·0.5H₂O Calcd. C, 72.26; H, 8.18; N, 6.32. Found C, 72.51; H, 7.93; N, 6.10.

Working Example 105 (Production of Compound 105)

[0513] To a solution of 1-(3-ethoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (250mg) in THF (10ml) were added thionyl chloride (0.080ml) and DMF (one droplet) at room temperature, and the mixture was stirred for 1.5 hours. The solvent was evaporated under reduced pressure, and the resulting residue was dissolved in THF (20ml), which was added dropwise to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (133mg) and triethylamine (0.46ml) in THF (3ml) at 0°C. The mixture was stirred at room temperature for 2.5 hours, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was purified with column chromatography (ethanol : ethyl acetate = 1 : 9 → 1 : 3), and the resulting crystals were purified by recrystallization (hexane-ethyl acetate) to give 1-(3-ethoxypropyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 105) (242mg) as yellow crystals.

mp 99 - 101°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.5 Hz), 1.23 (3H, t, J = 6.9 Hz), 1.53 - 1.82 (6H, m), 1.90 - 2.04 (2H, m), 2.21 (3H, s), 2.53 - 2.73 (1H, m), 2.87 - 2.96 (2H, m), 3.30 - 3.60 (14H, m), 3.81 (2H, t, J = 5.0 Hz), 3.98 - 4.10 (2H, m), 4.17 (2H, t, J = 5.0 Hz), 6.95 - 7.00 (3H, m), 7.30 (2H, d, J = 8.4 Hz), 7.36 - 7.58 (8H, m). IR (KBr) 3305, 1640, 1607, 1501, 1406, 1314, 1244, 1123 cm⁻¹.

Anal. Calcd. C₄₀H₅₃N₃O₅·0.25H₂O Calcd. C, 72.75; H, 8.18; N, 6.36. Found C, 72.81; H, 8.08; N, 6.27.

Working Example 106 (Production of Compound 106)

[0514] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-(3-ethoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (250mg) in THF (10ml) were added thionyl chloride (0.078ml) and DMF (one droplet) at room temperature, and the mixture was stirred for 1.5 hours. The solvent was evaporated under reduced pressure, and the resulting residue was dissolved in THF (20ml), which was added dropwise to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (128mg) and triethylamine (0.44ml) in THF (3ml) at 0°C. The mixture was stirred at room temperature for 64 hours, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was purified with column chromatography (ethanol : ethyl acetate = 1 : 4), and the resulting crystals were purified by recrystallization (hexane-ethyl acetate) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-ethoxypropyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 106) (224mg) as yellow crystals.

mp 95 - 97°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.24 (3H, t, J = 6.9 Hz), 1.30 - 1.48 (2H, m), 1.52 - 1.84 (6H, m), 1.90 - 2.06 (2H, m), 2.21 (3H, s), 2.52 - 2.75 (1H, m), 2.86 - 2.97 (2H, m), 3.30 - 3.60 (14H, m), 3.80 (2H, t, J = 5.0 Hz), 3.98 - 4.09 (2H, m), 4.16 (2H, t, J = 4.9 Hz), 6.94 - 7.03 (3H, m), 7.30 (2H, d, J = 8.4 Hz), 7.36 - 7.57 (8H, m). IR (KBr) 3323, 1638, 1607, 1516, 1501, 1406, 1314, 1244, 1123 cm⁻¹.

Anal. Calcd. C₄₁H₅₅N₃O₃ Calcd. C, 73.51; H, 8.28; N, 6.27. Found C, 73.60; H, 8.16; N, 6.23.

Working Example 107 (Production of Compound 107)

[0515] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-2,3-dihydro-1H-1-ben-

zazepine-4-carboxylic acid (300mg) in THF (10ml) were added thionyl chloride (0.068ml) and DMF (one droplet) at room temperature, and the mixture was stirred for 1 hour. The reaction mixture was added dropwise to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (151mg) and triethylamine (0.7ml) in THF (3ml) at 0°C. The mixture was stirred at room temperature for 20 hours, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethanol : ethyl acetate = 1 : 19 → 1 : 10), and the resulting crystals were purified by recrystallization (ethyl acetate-diisopropyl ether) to give 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 107) (144mg) as yellow crystals.

mp 123 - 126°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.31 - 1.47 (5H, m), 1.51 - 1.83 (6H, m), 2.21 (3H, s), 2.54 - 2.73 (1H, m), 2.86 - 2.97 (2H, m), 3.28 - 3.60 (10H, m), 3.80 (2H, t, J = 5.0 Hz), 3.93 - 4.09 (6H, m), 4.16 (2H, t, J = 5.0 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.32 (3H, m), 7.39 - 7.50 (8H, m).

IR (KBr) 3245, 1645, 1607, 1516, 1499, 1406, 1316, 1244, 1175, 1140, 1046 cm⁻¹.

Anal. Calcd. C₄₁H₅₃N₃O₅·0.25H₂O Calcd. C, 71.54; H, 7.83; N, 6.10. Found C, 71.49; H, 7.96; N, 6.03.

Working Example 108 (Production of Compound 108)

[0516] A mixture of 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (100mg), cerium chloride heptahydrate (300mg), sodium iodide (19mg) and acetonitrile (5ml) was stirred at 60°C for 5 days. Water was added to the reaction system, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethanol : ethyl acetate = 1 : 3) to give 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-oxopropyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (Compound 108) (52mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.32 - 1.47 (2H, m), 1.53 - 2.05 (6H, m), 2.26 (3H, s), 2.38 (3H, s), 3.29 - 3.47 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.74 - 3.86 (4H, m), 4.01 - 4.21 (6H, m), 6.54 (1H, d, J = 8.0 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.67 (10H, m).

IR (KBr) 3302, 1728, 1651, 1607, 1518, 1501, 1244, 914 cm⁻¹.

Working Example 109 (Production of Compound 109)

[0517] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (16.4g) in ethyl acetate (1500ml) was added 4N hydrochloric acid-ethyl acetate (25ml) at room temperature, and the mixture was stirred for 1 hour. The precipitated crystals were collected by filtration, which was purified by recrystallization (2-propanol) to give 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide dihydrochloride (Compound 109) (8.61g) as pale yellow crystals.

¹H-NMR (200 MHz, DMSO-d₆) δ 0.88 (3H, t, J = 7.1 Hz), 0.94 (3H, t, J = 7.3 Hz), 1.22 - 2.18 (10H, m), 2.57 (3H, s), 2.78 - 2.90 (2H, m), 3.21 - 3.41 (7H, m), 3.46 (2H, t, J = 6.4 Hz), 3.68 - 3.73 (2H, m), 3.91 - 4.15 (5H, m), 4.35 - 4.60 (1H, m), 6.97 - 7.02 (3H, m), 7.42 - 7.58 (6H, m), 7.65 (1H, s), 7.81 (2H, d, J = 8.4 Hz), 10.03 (1H, s), 10.45 - 10.59 (1H, m).

IR (KBr) 3248, 1663, 1609, 1521, 1501, 1464, 1312, 1248, 1180, 1121, 831 cm⁻¹.

Anal. Calcd. C₃₉H₅₃N₃O₄Cl₂ Calcd. C, 67.04; H, 7.65; N, 6.01. Found C, 67.10; H, 7.51; N, 6.14.

Working Example 110 (Production of Compound 110)

[0518] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide (2.0g) in ethanol (150ml) was added fumaric acid (371mg) at room temperature, and the mixture was stirred for 0.5 hour. After concentration under reduced pressure, to the residue was added ethyl acetate, and the precipitated crystals were collected by filtration, which was purified by recrystallization (2-propanol) to give 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxamide fumarate (Compound 110) (1.86g) as yellow crystals.

mp 159 - 161°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 0.99 (3H, t, J = 7.2 Hz), 1.30 - 1.45 (2H, m), 1.51 - 1.86 (8H, m), 2.24 (3H, s), 2.61 - 2.79 (1H, m), 2.86 - 2.95 (2H, m), 3.24 - 3.43 (6H, m), 3.55 (2H, t, J = 6.4 Hz), 3.62 (2H, s), 3.81 (2H, t, J = 5.0 Hz), 3.98 - 4.09 (2H, m), 4.16 (2H, t, J = 5.0 Hz), 6.90 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26

- 7.57 (12H, m).

IR (KBr) 3365, 1653, 1609, 1520, 1501, 1316, 1246, 1177 cm⁻¹.

Anal. Calcd. C₄₃H₅₅N₃O₈ Calcd. C, 69.61; H, 7.47; N, 5.66. Found C, 69.51; H, 7.46; N, 5.88.

5 Reference Example 294

[0519] To a solution of methyl 7-bromo-2,3-dihydro-1H-1-benzazepine-4-carboxylate (0.80g) and 3-methoxypropionaldehyde (1.25g) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (1.81g) at room temperature, and the mixture was stirred for 24 hours. Water was added to the reaction system, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 3 → 1 : 2) to give methyl 7-bromo-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (935mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.83 - 1.96 (2H, m), 2.79 (2H, t, J = 4.0 Hz), 3.22 (2H, t, J = 4.9 Hz), 3.34 (3H, s), 3.37 - 3.45 (4H, m), 3.80 (3H, s), 6.75 (1H, d, J = 9.2 Hz), 7.21 - 7.26 (1H, m), 7.42 (1H, d, J = 2.6 Hz), 7.57 (1H, s). IR (neat) 1699, 1626, 1588, 1539, 1495, 1435, 1256, 1177, 1117, 1086 cm⁻¹.

Reference Example 295

20 [0520] A mixture of methyl 7-bromo-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (450mg), 4-(2-propoxyethoxy)phenyl borate (313mg) and potassium carbonate (351mg) in toluene-ethanol-water (15-1.5-1.5ml) was stirred at room temperature for 1 hour under argon atmosphere. To the reaction system was added tetrakis(triphenylphosphine)palladium (73mg), and the mixture was heated to reflux for 20 hours. After cooled to room temperature, the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4 → 1 : 2) to give methyl 1-(3-methoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (376mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.3 Hz), 1.55 - 1.73 (2H, m), 1.86 - 2.03 (2H, m), 2.79 - 2.84 (2H, m), 3.26 - 3.31 (2H, m), 3.36 (3H, s), 3.42 - 3.55 (6H, m), 3.81 (3H, s), 3.83 (2H, t, J = 4.9 Hz), 4.16 (2H, t, J = 4.9 Hz), 6.92 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.38 - 7.51 (4H, m), 7.76 (1H, s). IR (neat) 1699, 1607, 1505, 1456, 1435, 1244, 1181, 1119 cm⁻¹.

Reference Example 296

35 [0521] To a solution of methyl 1-(3-methoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (376mg) in a mixture of THF-methanol (5-10ml) was added 1N sodium hydroxide solution (3.0ml) at room temperature, and the mixture was stirred at 50°C for 24 hours. After concentration under reduced pressure, 1N hydrochloric acid was added to pH 3-4, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration. The crystals were washed with diisopropyl ether and hexane to give 1-(3-methoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (346mg) as yellow crystals.

mp 114 - 115°C. ¹H-NMR (200 MHz, CDCl₃) δ 0.94 (3H, t, J = 7.3 Hz), 1.56 - 1.73 (2H, m), 1.88 - 2.04 (2H, m), 2.78 - 2.89 (2H, m), 3.24 - 3.35 (2H, m), 3.36 (3H, s), 3.43 - 3.55 (6H, m), 3.81 (2H, t, J = 5.0 Hz), 4.17 (2H, t, J = 5.0 Hz), 6.94 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.40 - 7.53 (4H, m), 7.88 (1H, s).

IR (KBr) 1671, 1607, 1501, 1273, 1252, 1186, 1115 cm⁻¹.

Anal. Calcd. C₂₈H₃₃NO₅ Calcd. C, 71.05; H, 7.57; N, 3.19. Found C, 70.78; H, 7.38; N, 3.01.

Reference Example 297

50 [0522] A mixture of methyl 7-bromo-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (478.2mg), 4-(2-butoxyethoxy)phenyl borate (354mg) and potassium carbonate (373mg) in toluene-ethanol-water (15-1.5-1.5ml) was stirred at room temperature for 1 hour under argon atmosphere. To the reaction system was added tetrakis(triphenylphosphine)palladium (78mg), and the mixture was heated to reflux for 16 hours. After cooled to room temperature, the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4 → 1 : 3 → 1 : 2) to give an end product (362mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.30 - 1.49 (2H, m), 1.53 - 1.69 (2H, m), 1.87 - 2.03 (2H, m),

2.78 - 2.86 (2H, m), 3.28 (2H, t, J = 4.8 Hz), 3.36 (3H, s), 3.42 - 3.50 (4H, m), 3.55 (2H, t, J = 6.7 Hz), 3.78 - 3.83 (5H, m), 4.16 (2H, t, J = 5.0 Hz), 6.90 - 7.00 (3H, m), 7.38 - 7.51 (4H, m), 7.76 (1H, s).
IR (neat) 1699, 1622, 1607, 1505, 1456, 1435, 1246, 1182, 1119, 818 cm⁻¹.

5 Reference Example 298

[0523] To a solution of methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (362.3mg) in a mixture of THF-methanol (5-10ml) was added 1N sodium hydroxide solution (2.8ml) at room temperature, and the mixture was stirred at 50°C for 15 hours. After concentration under reduced pressure, 1N hydrochloric acid was added to pH 3-4, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration. The crystals were washed with diisopropyl ether and hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-methoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (283mg) as yellow crystals.
mp 99 - 101°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.29 - 1.48 (2H, m), 1.53 - 1.70 (2H, m), 1.88 - 2.04 (2H, m), 2.80 - 2.89 (2H, m), 3.25 - 3.35 (2H, m), 3.37 (3H, s), 3.43 - 3.49 (4H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.94 (1H, d, J = 8.6 Hz), 6.98 (2H, d, J = 8.4 Hz), 7.40 - 7.53 (4H, m), 7.88 (1H, s).
IR (KBr) 1671, 1607, 1501, 1269, 1246, 1184, 1115 cm⁻¹.
Anal. Calcd. C₂₇H₃₅NO₅ Calcd. C, 71.50; H, 7.78; N, 3.09. Found C, 71.31; H, 7.75; N, 2.99.

20 Reference Example 299

[0524] To a solution of methyl 7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (400mg) and 3-ethoxypropionaldehyde (0.53g) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (0.66g) at room temperature, and the mixture was stirred for 20 hours. To the reaction system was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4 → 1 : 3) to give methyl 1-(3-ethoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (475mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.5 Hz), 1.23 (3H, t, J = 6.9 Hz), 1.52 - 1.72 (2H, m), 1.88 - 2.03 (2H, m), 2.80 - 2.84 (2H, m), 3.26 - 3.31 (2H, m), 3.43 - 3.55 (8H, m), 3.79 - 3.84 (5H, m), 4.16 (2H, t, J = 5.0 Hz), 6.94 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.40 (1H, dd, J = 8.8, 2.2 Hz), 7.47 (2H, d, J = 8.8 Hz), 7.51 (1H, d, J = 2.2 Hz), 7.76 (1H, s).

35 Reference Example 300

[0525] To a solution of methyl 1-(3-ethoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (475mg) in a mixture of THF-methanol (5-10ml) was added 1N sodium hydroxide solution (3.0ml) at room temperature, and the mixture was stirred at 50°C for 62 hours. After concentration under reduced pressure, to the mixture was added 1N hydrochloric acid (3.0ml), and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration. The crystals were washed with diisopropyl ether and hexane to give 1-(3-ethoxypropyl)-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (390mg) as yellow crystals.

mp 98 - 100°C.
¹H-NMR (200 MHz, CDCl₃) δ 0.95 (3H, t, J = 7.0 Hz), 1.23 (3H, t, J = 7.2 Hz), 1.53 - 1.74 (2H, m), 1.89 - 2.04 (2H, m), 2.79 - 2.89 (2H, m), 3.26 - 3.35 (2H, m), 3.44 - 3.55 (8H, m), 3.81 (2H, t, J = 5.0 Hz), 4.17 (2H, t, J = 5.0 Hz), 6.96 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.39 - 7.52 (4H, m), 7.87 (1H, s).
IR (KBr) 1669, 1607, 1501, 1275, 1248, 1184, 1125 cm⁻¹.

Anal. Calcd. C₂₇H₃₅NO₅ Calcd. C, 71.50; H, 7.78; N, 3.09. Found C, 71.23; H, 7.84; N, 3.16.

Reference Example 301

[0526] To a solution of methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (400mg) and 3-ethoxypropionaldehyde (0.52g) in 1,2-dichloroethane (10ml) was added sodium triacetoxymethylborohydride (0.64g) at room temperature; and the mixture was stirred for 20 hours. To the reaction system was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography.

matography (ethyl acetate : hexane = 1 : 4 → 1 : 3) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-ethoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (452mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.23 (3H, t, J = 7.1 Hz), 1.28 - 1.68 (4H, m), 1.89 - 2.06 (2H, m), 2.78 - 2.87 (2H, m), 3.27 - 3.31 (2H, m), 3.43 - 3.59 (8H, m), 3.78 - 3.83 (5H, m), 4.16 (2H, t, J = 4.9 Hz), 6.94 (1H, d, J = 8.4 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.37 - 7.52 (4H, m), 7.76 (1H, s).

IR (neat) 1699, 1622, 1609, 1501, 1454, 1435, 1373, 1354, 1246, 1181, 1125, 818 cm⁻¹.

Reference Example 302

[0527] To a solution of methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(3-ethoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (452mg) in a mixture of THF-methanol (5-10ml) was added 1N sodium hydroxide solution (3.0ml) at room temperature, and the mixture was stirred at 50°C for 40 hours. After concentration under reduced pressure, to the mixture was added 1N hydrochloric acid (3.0ml), and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration. The crystals were washed with hexane to give 7-[4-(2-butoxyethoxy)phenyl]-1-(3-ethoxypropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (340mg) as yellow crystals.

mp 76 - 78°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.23 (3H, t, J = 7.0 Hz), 1.30 - 1.47 (2H, m), 1.53 - 1.68 (2H, m), 1.88 - 2.04 (2H, m), 2.79 - 2.88 (2H, m), 3.26 - 3.37 (2H, m), 3.44 - 3.59 (8H, m), 3.81 (2H, t, J = 4.9 Hz), 4.16 (2H, t, J = 4.9 Hz), 6.96 (1H, d, J = 8.8 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.40 - 7.54 (4H, m), 7.88 (1H, s).

IR (KBr) 1667, 1607, 1501, 1271, 1248, 1184, 1125 cm⁻¹.

Anal. Calcd. C₂₈H₃₇NO₅ Calcd. C, 71.92; H, 7.98; N, 3.00. Found C, 71.89; H, 8.08; N, 2.68.

Reference Example 303

[0528] A mixture of palladium chloride (96mg) and cuprous chloride (218mg) in DMF-water (7-1ml) was stirred at 60°C for 18 hours under oxygen atmosphere. To the reaction system was added a solution of methyl 7-bromo-1-(2-propenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (500mg) in DMF-water (7-1ml) was added, and the mixture was stirred at 60°C for 7 hours. To the reaction system was added saturated brine, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4 → 1 : 2) to give methyl 7-bromo-1-(2-oxopropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (311mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 2.21 (3H, s), 2.82 (2H, t, J = 4.6 Hz), 3.30 (2H, t, J = 4.6 Hz), 3.81 (3H, s), 4.08 (2H, s), 6.31 (1H, d, J = 8.8 Hz), 7.21 (1H, dd, J = 8.8, 2.2 Hz), 7.46 (1H, d, J = 2.2 Hz), 7.59 (1H, s).

Reference Example 304

[0529] A solution of methyl 7-bromo-1-(2-oxopropyl)-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.29g), ethylene glycol (2.3g) and p-toluenesulfonic acid monohydrate (36mg) in toluene (10ml) was heated to reflux for 3 days while removing water. After cooled to room temperature, an aqueous solution of sodium hydrogen carbonate was added to alkaline, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4) to give methyl 7-bromo-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (992mg).

mp 96 - 99°C.

¹H-NMR (200 MHz, CDCl₃) δ 1.57 (3H, s), 2.78 - 2.83 (2H, m), 3.34 - 3.39 (2H, m), 3.43 (2H, s), 3.80 (3H, s), 3.88 - 3.99 (4H, m), 7.13 (1H, d, J = 9.2 Hz), 7.22 - 7.27 (1H, m), 7.42 (1H, d, J = 2.2 Hz), 7.58 (1H, s).

IR (KBr) 1703, 1626, 1495, 1435, 1258, 1217, 1179, 1086, 1047 cm⁻¹.

Anal. Calcd. C₁₇H₂₀NO₄Br Calcd. C, 53.42; H, 5.27; N, 3.66. Found C, 53.34; H, 5.50; N, 3.64.

Reference Example 305

[0530] A mixture of methyl 7-bromo-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (960mg), 4-(2-butoxyethoxy)phenyl borate (0.66g) and potassium carbonate (0.69g) in a mixture of toluene-ethanol-water (25-2.5-2.5ml) was stirred at room temperature for 1 hour under argon atmosphere. To the reaction system was added tetrakis(triphenyl)phosphinepalladium (144mg), and the mixture was heated to reflux for 8 hours. After cooled to room temperature, the mixture was extracted with ethyl acetate, and the mixture was dried with mag-

nesium-sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (796mg) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.31 - 1.47 (5H, m), 1.52 - 1.67 (2H, m), 1.78 - 1.86 (2H, m), 3.41 - 3.45 (2H, m), 3.49 (2H, s), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (5H, m), 3.97 (4H, s), 4.16 (2H, t, J = 5.0 Hz), 6.98 (2H, d, J = 8.8 Hz), 7.26 - 7.30 (1H, m), 7.39 - 7.51 (4H, m), 7.77 (1H, s).

IR (neat) 1699, 1609, 1505, 1495, 1435, 1242, 1181, 1127, 1047 cm⁻¹.

Reference Example 306

[0531] To a solution of methyl 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (795.7mg) in a mixture of THF-methanol (5-5ml) was added 1N sodium hydroxide solution (3.2ml) at room temperature, and the mixture was stirred at 50°C for 16 hours. After concentration under reduced pressure, to the mixture was added 1N hydrochloric acid (4ml) and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration. The crystals were washed with diisopropyl ether to give 7-[4-(2-butoxyethoxy)phenyl]-1-[(2-methyl-1,3-dioxolan-2-yl)methyl]-7-[4-(2-propoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (664mg) as yellow crystals.

mp 127 - 129°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.4 Hz), 1.30 - 1.49 (5H, m), 1.52 - 1.68 (2H, m), 2.81 - 2.89 (2H, m), 3.41 - 3.49 (2H, m), 3.51 (2H, s), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, t, J = 5.0 Hz), 3.91 - 4.01 (4H, m), 4.17 (2H, t, J = 5.0 Hz), 6.98 (2H, t, J = 8.8 Hz), 7.26 - 7.32 (1H, m), 7.41 - 7.53 (4H, m), 7.89 (1H, s).

IR (KBr) 1665, 1611, 1503, 1427, 1246, 1184, 1046 cm⁻¹.

Anal. Calcd. C₂₈H₃₅NO₆ Calcd. C, 69.83; H, 7.33; N, 2.91. Found C, 69.78; H, 7.39; N, 2.81.

Reference Example 307

[0532] To a solution of 7-bromo-2,3,4,5-tetrahydro-1H-1-benzazepine-5-one (5.0g), propionaldehyde (15ml) and acetic acid (4.7ml) in 1,2-dichloroethane (250ml) was added sodium triacetoxyborohydride (22.0g) at room temperature, and the mixture was stirred for 6 hours. To the reaction system was added water, and the mixture was extracted with ethyl acetate. The organic layer was washed with an aqueous solution of sodium hydrogen carbonate and saturated brine, and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 4) to give 7-bromo-1-propyl-2,3,4,5-tetrahydro-1H-1-benzazepine-5-one (5.89g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 1.00 (3H, t, J = 7.4 Hz), 1.58 - 1.81 (2H, m), 2.18 - 2.33 (2H, m), 2.75 (2H, t, J = 7.2 Hz), 3.26 (2H, t, J = 6.6 Hz), 3.38 (2H, t, J = 7.7 Hz), 6.76 (1H, d, J = 9.0 Hz), 7.34 (1H, dd, J = 9.0, 2.6 Hz), 7.84 (1H, d, J = 2.6 Hz).

IR (neat) 1667, 1590, 1487, 1443, 1412, 1381, 1366, 1337, 1296, 1281, 1252, 1223, 1206, 1161, 1136, 1117, 808 cm⁻¹.

Reference Example 308

[0533] A mixture of 7-bromo-1-propyl-2,3,4,5-tetrahydro-1H-1-benzazepine-5-one (5.89g), 4-(2-butoxyethoxy)phenyl borate (5.45g) and potassium carbonate (5.74g) in toluene-ethanol-water (200-20-20ml) was stirred at room temperature for 1 hour under argon atmosphere. To the reaction system was added tetrakis(triphenylphosphine)palladium (0.72g), and the mixture was heated to reflux for 3 hours. After cooled to room temperature, the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was separated and purified with column chromatography (ethyl acetate : hexane = 1 : 9 → 1 : 4) to give 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-2,3,4,5-tetrahydro-1H-1-benzazepine-5-one (7.15g) as yellow oil.

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.3 Hz), 1.02 (3H, t, J = 7.5 Hz), 1.29 - 1.47 (2H, m), 1.52 - 1.84 (4H, m), 2.18 - 2.35 (2H, m), 2.80 (2H, t, J = 7.1 Hz), 3.31 (2H, t, J = 6.6 Hz), 3.44 (2H, t, J = 7.5 Hz), 3.55 (2H, t, J = 6.8 Hz), 3.80 (2H, t, J = 4.9 Hz), 4.15 (2H, t, J = 4.9 Hz), 6.92 - 6.98 (3H, m), 7.46 - 7.54 (3H, m), 7.96 (1H, d, J = 2.6 Hz).

Reference Example 309

[0534] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-2,3,4,5-tetrahydro-1H-1-benzazepine-5-one (500mg) in THF (15ml) was added dropwise lithium bis(trimethylsilyl)amide (1.0M solution in hexane, 3.8ml) at -78°C under argon atmosphere. After stirred at -78°C for 2 hours, argon was removed under reduced pressure to replace it with

carbon dioxide. The reaction mixture was removed from an acetone-dry ice bath, and stirred at room temperature for 2 hours. To the reaction system were added water and ethyl acetate, and 1N hydrochloric acid was slowly added at 0°C until pH 6. The mixture was extracted with ethyl acetate, the organic layer was washed with saturated brine and dried with magnesium sulfate. Concentration by rotary evaporator under reduced pressure afforded yellow oil (981mg).

5 **[0535]** To a solution of the oil (980.9mg) in ethanol (20ml) was added sodium borohydride (0.48g), and the mixture was stirred at room temperature for 2 hours under nitrogen atmosphere. Ethanol was evaporated under reduced pressure, and water and ethyl acetate were added thereto. 1N hydrochloric acid was slowly added at 0°C until pH 6. The mixture was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. After concentration by rotary evaporator under reduced pressure, concentrated hydrochloric acid (1.5ml) was

10 added to a solution of the e residue (769mg) in 1,2-dimethoxyethane (20ml) at room temperature, and the mixture was heated to reflux for 1 hour. After cooled to room temperature, water and ethyl acetate were added thereto. 1N sodium hydroxide solution was added dropwise at 0°C until pH=4. The mixture was extracted with ethyl acetate, and water was added to the organic layer, followed by addition of 1N sodium hydroxide solution until pH 6. The solution was separated, and the organic layer was washed with water and saturated brine and dried with magnesium sulfate. After

15 concentration under reduced pressure, the residue was separated and purified with silica gel column chromatography (ethyl acetate : hexane = 1 : 2 → 1 : 1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (374mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.96 - 1.02 (6H, m), 1.34 - 1.45 (2H, m), 1.54 - 1.80 (4H, m), 2.84 (2H, m), 3.28 - 3.35 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.80 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.88 (1H, d, J = 8.8 Hz), 6.98 (2H, t, J = 8.8 Hz), 7.39 - 7.52 (4H, m), 7.88 (1H, s).

20

Reference Example 310

[0536] To a solution of methyl 7-[4-(2-butoxyethoxy)phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylate (1.0g, 2.53mmol) and propionaldehyde (1ml, 13.86mmol) in 1,2-dichloroethane (30ml) was added sodium triacetoxyborohydride (1.9g, 8.96mmol) at room temperature, and the mixture was stirred for 24 hours. To the reaction system was added 1N sodium hydroxide solution, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the residue was dissolved in THF (50ml) and methanol (50ml), and to the solution was added 1N sodium hydroxide solution.

30 After heating to reflux for 1 hour, the mixture was concentrated under reduced pressure. To the residue was added 1N hydrochloric acid, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and saturated brine and dried with magnesium sulfate. After concentration under reduced pressure, the resulting crystals were collected by filtration to give 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (0.895g) as yellow crystals.

35 mp 145 - 146°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.96 - 1.02 (6H, m), 1.34 - 1.45 (2H, m), 1.54 - 1.80 (4H, m), 2.84 (2H, m), 3.28 - 3.35 (4H, m), 3.55 (2H, t, J = 6.6 Hz), 3.80 (2H, t, J = 5.0 Hz), 4.16 (2H, t, J = 5.0 Hz), 6.88 (1H, d, J = 8.8 Hz), 6.98 (2H, t, J = 8.8 Hz), 7.39 - 7.52 (4H, m), 7.88 (1H, s).

IR (KBr) 2975, 2925, 2870, 1670, 1605, 1500 cm⁻¹.

40 Anal. Calcd. C₂₆H₃₃NO₄ Calcd. C, 73.73; H, 7.85; N, 3.31. Found C, 73.68; H, 8.11; N, 3.23.

Reference Example 311

[0537] 4-morpholinophenyl borate (237mg) and 7-bromo-1-propyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (391mg) were dissolved in water : ethanol : toluene (= 1 : 1 : 10, v/v, 18.0ml), and potassium carbonate (253mg) was added thereto. This mixture was stirred at room temperature for 30 minutes under argon atmosphere, tetrakis(triphenylphosphine)palladium (35mg) was added thereto, and the mixture was heated to reflux for 10 hours under argon atmosphere. The reaction mixture was diluted with ethyl acetate, and washed with water and saturated brine. The organic layer was dried with anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure. The residue was purified with silica gel column chromatography (ethyl acetate → ethyl acetate:ethanol = 10:1), which was further recrystallized from ethyl acetate-diisopropyl ether-hexane to give N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-morpholinophenyl)-1-propyl-2,3-dihydro-1-benzazepine-4-carboxamide (222mg) as yellow crystals.

50 mp 114 - 118°C.

¹H-NMR (200 MHz, CDCl₃) δ 0.99 (3H, t, J = 7.4 Hz), 1.64 - 1.81 (6H, m), 2.21 (3H, s), 2.57 - 2.70 (1H, m), 2.92 (2H, t, J = 4.8 Hz), 3.20 (4H, t, J = 4.8 Hz), 3.28 - 3.43 (6H, m), 3.57 (2H, s), 3.89 (4H, t, J = 4.8 Hz), 4.01 - 4.07 (2H, m), 6.90 (1H, d, J = 8.8 Hz), 6.97 (2H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.8 Hz), 7.39 - 7.56 (8H, m).

IR (KBr) 2955, 1649, 1605, 1512, 1503, 1451, 1406, 1312, 1233, 1175, 1119, 928, 812, 733 cm⁻¹.

55

Anal. Calcd. for $C_{37}H_{45}N_4O_3$ (1.1H₂O) : C, 72.31; H, 7.90; N, 9.12. Found C, 72.09; H, 7.66; N, 8.87.

Reference Example 312

[0538] One droplet of DMF was added to a solution of 1-(2-methoxybenzyl)-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (340mg) in tetrahydrofuran (10ml). Then, thionyl chloride (267mg) was added thereto at 0°C, the temperature was returned to room temperature, and the mixture was stirred for 1 hour under nitrogen atmosphere. The solvent and excess thionyl chloride were evaporated under reduced pressure, and the resulting residue was suspended in tetrahydrofuran (30ml), which was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (197mg) and triethylamine (906mg) in tetrahydrofuran (10ml) at 0°C. The mixture was stirred at room temperature for 1 hour under nitrogen atmosphere, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 8), which was recrystallized from hexane-ethyl acetate to give 1-(2-methoxybenzyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide (337mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 1.05 (t, 3H, J = 7.2 Hz), 1.60 - 1.88 (m, 6H), 2.21 (s, 3H), 2.64 (br, 1H), 2.90 (br, 2H), 3.32 - 3.45 (m, 4H), 3.57 (s, 2H), 3.89 (s, 3H), 3.92 - 4.08 (m, 4H), 4.59 (s, 2H), 6.82 (d, 1H, J = 8.8 Hz), 6.92 - 6.97 (m, 4H), 7.15 - 7.22 (m, 1H), 7.26 - 7.38 (m, 4H), 7.44 - 7.60 (m, 7H).

Reference Example 313

[0539] One droplet of DMF was added to a solution of 1-[(1-ethylpyrazol-4-yl)methyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (330mg) in dichloromethane (15ml). Then, thionyl chloride (118mg) was added thereto at 0°C, the temperature was returned to room temperature, and the mixture was stirred for 1 hour under nitrogen atmosphere. Then, this solution was added to a solution of 4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline (219mg) and triethylamine (2.01g) in dichloromethane (15ml) at 0°C. The mixture was stirred at room temperature for overnight under nitrogen atmosphere, water was added thereto, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. The solvent was evaporated under reduced pressure, and the resulting residue was separated and purified with silica gel column chromatography (methanol : ethyl acetate = 1 : 4), which was recrystallized from hexane-ethyl acetate to give 1-[(1-ethylpyrazol-4-yl)methyl]-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-(4-propoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide (362mg) as yellow crystals.

¹H-NMR (200 MHz, CDCl₃) δ 1.05 (t, 3H, J = 7.4 Hz), 1.49 (t, 3H, J = 7.4 Hz), 1.58 - 1.88 (m, 6H), 2.21 (s, 3H), 2.65 (br, 1H), 2.84 (br, 2H), 3.25 - 3.42 (m, 4H), 3.57 (s, 2H), 3.93 - 4.06 (m, 4H), 4.16 (q, 2H, J = 7.4 Hz), 4.40 (s, 2H), 6.94 - 7.01 (m, 3H), 7.26 - 7.40 (m, 4H), 7.45 - 7.56 (m, 8H).

Anal. Calcd. $C_{39}H_{47}N_5O_3$ Calcd. C, 73.90; H, 7.47; N, 11.05. Found C, 73.58; H, 7.47; N, 10.86.

Reference Example 314

[0540] Methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(tetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.9g) was dissolved in acetonitrile (190ml). To the solution were added potassium carbonate (1.65g) and ethyl iodide (0.76ml), and the mixture was stirred at 50°C for 16 hours. The solvent was concentrated to 1/3 under reduced pressure, which was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (hexane/ethyl acetate=3/1 → 1/2) to give methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.05g) and methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.42g).

¹H-NMR (1-ethyl compound; 200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.44 (3H, t, J = 7.0 Hz), 1.47 - 1.66 (2H, m), 2.58 (2H, t, J = 4.6 Hz), 3.37 (2H, t, J = 5.0 Hz), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.84 (2H, m), 3.81 (3H, s), 4.13 - 4.19 (2H, m), 4.31 (2H, q, J = 7.0 Hz), 4.84 (2H, s), 6.95 - 7.02 (3H, m), 7.42 - 7.49 (3H, m), 7.57 (1H, m), 7.78 (1H, s).

¹H-NMR (2-ethyl compound; 200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.33 - 1.49 (2H, m), 1.57 - 1.65 (2H, m), 1.65 (3H, t, J = 7.4 Hz), 2.83 - 2.91 (2H, m), 3.39 - 3.45 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.78 - 3.83 (2H, m), 3.82 (3H, s), 4.07 - 4.18 (2H, m), 4.67 (2H, q, J = 7.4 Hz), 4.75 (2H, s), 6.98 (2H, d, J = 8.8 Hz), 7.16 (1H, d, J = 8.4 Hz), 7.40 - 7.54 (4H, m), 7.79 (1H, s).

Reference Example 315

[0541] Methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(1-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (0.11g) was dissolved in THF (2.2ml)/methanol (2.2ml). To the solution was added 1N sodium hydroxide (1.1ml), and the mixture was stirred at 50°C for 4 hours. After cooled to room temperature, pH was adjusted to approximate 5 with 6N hydrochloric acid, and the solvent was removed to half under reduced pressure. The material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the residue was washed with hexane/ethyl acetate (8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(1-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.10g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.34 - 1.45 (2H, m), 1.46 (3H, t, J = 7.4 Hz), 1.54 - 1.65 (2H, m), 2.62 (2H, m), 3.40 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.78 - 3.84 (2H, m), 4.14 - 4.19 (2H, m), 4.29 (2H, q, J = 7.4 Hz), 4.86 (2H, s), 6.99 (3H, d, J = 8.8 Hz), 7.44 - 7.49 (3H, m), 7.58 (1H, d, J = 2.2 Hz), 7.88 (1H, s). IR (KBr) 2957, 2932, 1667, 1609, 1505, 1435, 1273, 1244, 1119, 828, 797 cm⁻¹.

Working Example 111 (Production of Compound 111)

[0542] In THF (6.0ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(1-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.10g). To the solution was added DMF (two droplets), followed by addition of oxalyl chloride (35μl) at 0°C and stirring at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]phenylalanine (50mg) and triethylamine (0.17ml) in THF (6.0ml) at 0°C, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol = 3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(1-ethyltetrazol-5-ylmethyl)-N-[4-[N-methyl-N-(tetrahydropyranyl-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 111) (34mg).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.46 (3H, t, J = 7.2 Hz), 1.57 - 1.75 (6H, m), 2.21 (3H, s), 2.68 (3H, m), 3.36 - 3.43 (4H, m), 3.51 - 3.59 (2H, m), 3.59 (2H, s), 3.77 - 3.83 (2H, m), 4.00 - 4.17 (4H, m), 4.32 (2H, q, J = 7.2 Hz), 4.81 (2H, s), 6.98 (3H, d, J = 8.8 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.42 - 7.82 (8H, m). IR (KBr) 3277, 2934, 1651, 1607, 1505, 1242, 822 cm⁻¹.

Reference Example 316

[0543] In THF (20.8ml)/methanol (20.8ml) was dissolved methyl 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylate (1.04g). To the solution was added 1N sodium hydroxide (10.4ml), and the mixture was stirred at 50°C for 4 hours. After cooled to room temperature, pH was adjusted to approximate 5 with 6N hydrochloric acid, and the solvent was removed to half under reduced pressure. The material was extracted with ethyl acetate, and the extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was washed with hexane/ethyl acetate (8/1) to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.76g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.0 Hz), 1.33 - 1.45 (2H, m), 1.55 - 1.65 (2H, m), 1.66 (3H, t, J = 7.4 Hz), 2.88 (2H, m), 3.45 (2H, m), 3.56 (2H, t, J = 6.6 Hz), 3.81 (2H, m), 4.13 - 4.18 (2H, m), 4.68 (2H, q, J = 7.4 Hz), 4.77 (2H, s), 6.98 (2H, d, J = 8.8 Hz), 7.17 (1H, d, J = 8.8 Hz), 7.41 - 7.49 (3H, m), 7.55 (1H, d, J = 2.2 Hz), 7.91 (1H, s). IR (KBr) 3034, 2934, 1672, 1607, 1501, 1404, 1246, 1190, 1132, 816 cm⁻¹.

Working Example 112 (Production of Compound 112)

[0544] In THF (15ml) was dissolved 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethyltetrazol-5-ylmethyl)-2,3-dihydro-1-benzazepine-4-carboxylic acid (0.75mg). To the solution was added DMF (three droplets), followed by addition of oxalyl chloride (0.26ml) at 0°C and stirring at room temperature for 1 hour. The solvent was removed under reduced pressure, a solution of the resulting residue in THF was added dropwise to a solution of 4-[methyl(tetrahydropyranyl-4-yl)aminomethyl]phenylalanine (0.38g) and triethylamine (1.26ml) in THF (11.4ml) at 0°C, and the mixture was stirred at room temperature for 2 hours. The reaction solution was added to water, and the mixture was extracted with ethyl acetate. The extract was washed with saturated brine and dried with magnesium sulfate. The solvent was removed under reduced pressure, and the resulting residue was purified with silica gel column chromatography (ethyl acetate/ethanol=3/1), which was recrystallized from hexane/ethyl acetate to give 7-[4-(2-butoxyethoxy)phenyl]-1-(2-ethyltetrazol-

5-ylmethyl)-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)aminomethyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide (Compound 112) (0.48g).

¹H-NMR (200 MHz, CDCl₃) δ 0.93 (3H, t, J = 7.2 Hz), 1.33 - 1.45 (2H, m), 1.54 - 1.78 (6H, m), 1.66 (3H, t, J = 7.2 Hz), 2.21 (3H, s), 2.65 (1H, m), 2.95 (2H, m), 3.30 - 3.43 (2H, m), 3.46 - 3.50 (2H, m), 3.55 (2H, t, J = 6.6 Hz), 3.57 (2H, s), 3.77 - 3.83 (2H, m), 3.99 - 4.08 (2H, m), 4.12 - 4.18 (2H, m), 4.68 (2H, q, J = 7.2 Hz), 4.78 (2H, s), 6.98 (2H, d, J = 8.8 Hz), 7.18 (1H, d, J = 8.4 Hz), 7.30 (2H, d, J = 8.8 Hz), 7.39 - 7.59 (8H, m).

IR (KBr) 3306, 2934, 1644, 1505, 1244, 1140, 812 cm⁻¹.

Anal. Calcd. C₄₀H₅₁N₇O₄ Calcd. C, 69.24; N, 14.13; H, 7.41. Found C, 69.04; N, 14.04; H, 7.44.

Working Example 113 (Production of Compound 27)

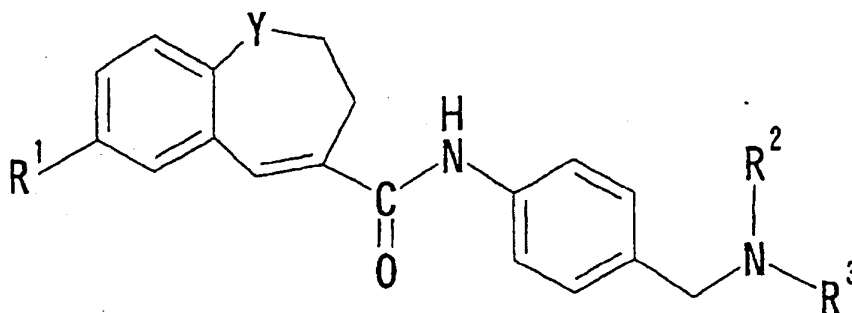
[0545] To a solution of 7-[4-(2-butoxyethoxy)phenyl]-1-propyl-N-[4-[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1H-1-benzazepine-4-carboxylic acid (4.00g in THF (40ml)) were added thionyl chloride (1.72ml) and DMF (0.5ml) at room temperature, and the mixture was stirred for 1 hour. After concentration under reduced pressure, the residue was dissolved in THF (50ml) and DMF (10 ml), which was added dropwise to a mixture of 4-[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]aniline dihydrochloride (3.05g) and triethylamine (7.9ml) in THF (30ml) at 0°C. After stirred at room temperature for 16 hours, water was added to the reaction system, and the mixture was extracted with ethyl acetate. The organic layer was washed with saturated brine and dried with magnesium sulfate. After concentrated under reduced pressure, the residue was separated and purified with column chromatography (ethanol : ethyl acetate = 1 : 19), which was further purified by recrystallization (2-propanol) to give an end product (Compound 27) (4.19g) as yellow crystals.

Industrial Applicability

[0546] The compound of the formula (I) of the present invention or a salt thereof has potent CC chemokine receptor (CCR) antagonistic activity, in particular, potent CCR5 antagonistic activity and, thus, it can be advantageously used for the treatment or prevention of infectious disease of various HIV in human (e.g., AIDS).

Claims

1. A compound of the formula (I):



wherein R¹ is a 5- to 6-membered aromatic ring which has a group of the formula: R-Z¹-X-Z²- wherein R is a hydrogen atom or an optionally substituted hydrocarbon group, X is an optionally substituted alkylene chain, and Z¹ and Z² are respectively hetero-atoms, and which may have a further substituent, the group R may bind to the 5- to 6-membered aromatic ring to form a ring, Y is an optionally substituted imino group, R² and R³ are respectively an optionally substituted aliphatic hydrocarbon group or an optionally substituted alicyclic heterocyclic group; or a salt thereof.

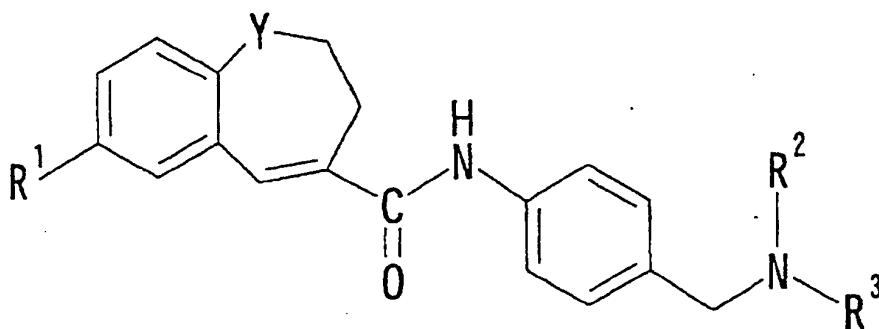
2. A pro-drug of the compound according to claim 1 or a salt thereof.

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- 55

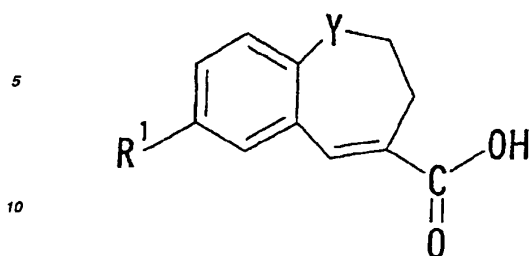
nyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide,
 7-(4-butoxyethoxyphenyl)-1-cyclopropylmethyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-
 2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)
 amino]methyl]phenyl]-1-phenyl-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-1-(3,4-me-
 5 thylenedioxy)phenyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-
 4-carboxamide, 7-(4-butoxyethoxyphenyl)-1-(2-methyloxazol-5-yl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)ami-
 no]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide, 1-allyl-7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-
 N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphe-
 10 nyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(3-thienyl)methyl-2,3-dihydro-1-benzaze-
 pine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-
 1-(thiazol-2-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-1-(1-methylpyrazol-
 4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carbox-
 amide, 7-(4-butoxyethoxyphenyl)-1-(3-methylisothiazol-4-yl)methyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)ami-
 15 no]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-1-(1-ethylpyrazol-4-yl)
 methyl-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-2,3-dihydro-1-benzazepine-4-carboxa-
 mide, 7-(4-butoxyethoxyphenyl)-1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-2,3-dihy-
 dro-1-benzazepine-4-carboxamide, 1-isobutyl-N-[4-[[N-methyl-N-(tetrahydropyran-5-yl)amino]methyl]phenyl]-7-
 (4-propoxyethoxyphenyl)-2,3-dihydro-1-benzazepine-4-carboxamide, 7-(4-butoxyethoxyphenyl)-N-[4-[[N-me-
 20 thyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(thiazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxa-
 mide, 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tetrahydropyran-4-yl)amino]methyl]phenyl]-1-(1-methyltetra-
 zol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxamide, and 7-(4-butoxyethoxyphenyl)-N-[4-[[N-methyl-N-(tet-
 rahydropyran-4-yl)amino]methyl]phenyl]-1-(2-methyltetrazol-5-yl)methyl-2,3-dihydro-1-benzazepine-4-carboxa-
 mide, or salt thereof.

24. A pro-drug of the compound according to claim 23 or a salt thereof.

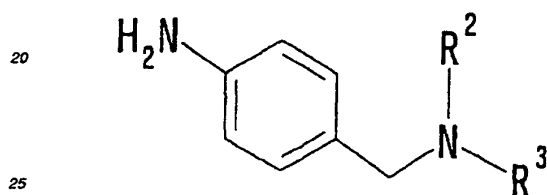
25. A method for producing a compound of the formula:



wherein each symbol is as defined in claim 1, or a salt thereof, which comprises subjecting a compound of the formula:



15 wherein each symbol is as defined in claim 1, a salt or a reactive derivative thereof to a condensation reaction with a compound of the formula:



wherein each symbol is as defined in claim 1, or a salt thereof.

- 30 26. A pharmaceutical composition which comprises the compound according to claim 1 or a salt thereof.
27. The composition according to claim 26, which is a CC chemokine receptor antagonist.
- 35 28. The pharmaceutical composition according to claim 26, which is a CCR5 antagonist.
29. The composition according to claim 26, which is for the treatment or prevention of infectious disease of HIV.
30. The composition according to claim 26, which is for the treatment or prevention of AIDS.
- 40 31. The composition according to claim 26, which is for the prevention of the progression of AIDS.
32. The composition according to claim 29, which is used in combination with a protease inhibitor and/or a reverse transcriptase inhibitor.
- 45 33. The composition according to claim 32, wherein the reverse transcriptase inhibitor is zidovudine, didanosine, zalcitabine, lamivudine, stavudine, nevirapine, delavirdine, efavirenz or abacavir.
34. The composition according to claim 32, wherein the protease inhibitor is saquinavir, ritonavir, indinavir or nelfinavir.
- 50 35. Use of the compound according to claim 1 or a salt thereof in combination with a protease inhibitor and/or a reverse transcriptase inhibitor for the treatment or prevention of infectious disease of HIV.
36. A method for antagonizing a CC chemokine receptor in a mammal, which comprises administering an effective amount of a compound according to claim 1 or a salt thereof to a mammal.
- 55 37. Use of a compound according to claim 1 or a salt thereof in preparation of a medicament for antagonizing a CC chemokine receptor.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/03879

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ C07D405/12, 405/14, 409/14, 413/14, 417/14, A61K31/55, A61P31/18, 43/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ C07D405/12, 405/14, 409/14, 413/14, 417/14, A61K31/55, A61P31/18, 43/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CA, REGISTRY (STN)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, 825186, A1 (PFIZER INC.), 25 February, 1998 (25.02.98) & JP, 10-87631, A & CA, 2213108, A & US, 6043238, A	1-34, 37
PX	WO, 99/32100, A2 (TAKEDA CHEMICAL INDUSTRIES LTD.), 01 July, 1999 (01.07.99), Full text & AU, 9916831, A & JP, 2000-128782, A & US, 6096780, A	1-34, 37
PX	WO, 99/32468, A1 (TAKEDA CHEMICAL INDUSTRIES LTD.), 01 July, 1999 (01.07.99), Full text & AU, 9916830, A & JP, 11-263764, A	1-26
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 09 August, 2000 (09.08.00)		Date of mailing of the international search report 22 August, 2000 (22.08.00)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/03879

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 35,36
because they relate to subject matter not required to be searched by this Authority, namely:
The inventions of claims 35 and 36 fall under the category of methods for treatment of the human body by therapy.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (I)) (July 1992)